THE

FRANKLIN JOURNAL,

AND

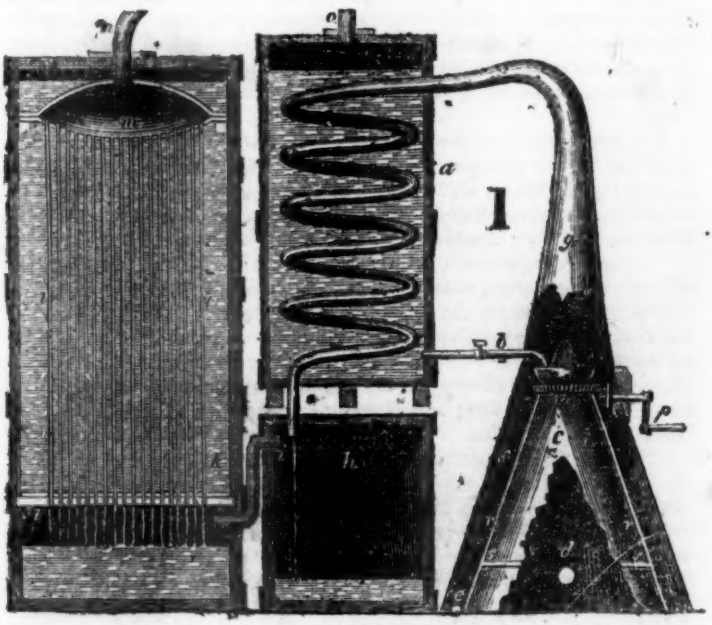
AMERICAN MECHANICS' MAGAZINE;

DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

JANUARY, 1828.

APPARATUS FOR EVAPORATION AND DISTILLATION.



VOL. V.—NO. 1.—JANUARY, 1828.—1

Description of an Improved Apparatus for Evaporation and Distillation, which is also applicable to several other purposes, such as the concentration of saline liquids, the generation of steam, the manufacture of Vinegar, Verdigris, &c.

In the fifth number of the last volume we gave a description of some recent improvements in the distilling apparatus, and intended to have continued the same subject in the succeeding number, but were compelled to postpone it until the present period. The nature of the revenue laws of Great Britain, as relates to distillation, and various other important considerations, has led to numerous attempts to accelerate this process, some of which have been eminently successful. This subject is evidently connected with various efforts which have been made to improve the steam engine, as a main object in each, is the production of vapour, by means of fire. In many of the patents which have been obtained for improved modes of generating steam, the application of the same apparatus to the purpose of distillation has been pointed out; whilst in others, which were primarily intended to be applied to distillation, it has been proposed to use them also as boilers for steam engines.

The apparatus which we are about to describe, appears, from the letter of its inventor, not to have been subjected to the test of experiment, but to be a new proposition, submitted to the judgment of those who are acquainted with the subject. We perceive some practical objections to its use in certain of the ways designated, but think it worth presenting to our readers; for should it be, like most novel propositions, imperfect, it may yet suffice to suggest useful ideas to others.

The gentleman who proposes the plan, after making some remarks upon the known effect of increasing the surface in promoting evaporation, states that he was most forcibly struck with the rapidity with which the moisture from a wet towel was converted into steam, on holding it before a common fire, and says,

"I then thought that the towel afforded a hint for the construction of a steam generating apparatus, and that absorbent, porous materials, would be the best for the purpose, if they could be arranged conveniently, and were good conductors of caloric. Since then, it appeared to me that I might adopt metal, and apply a very extended surface for the generation of vapour, in a manner more convenient, than the close boiler; and with vastly greater effect, however shallow that boiler might be made.

"Having determined upon the form of my vessel, or rather *machine*, for the production of vapour, I next considered of a plan for its rapid condensation, in which I flatter myself I have been equally successful, notwithstanding it possesses much less novelty in its arrangements, than the former.

"I shall now describe my apparatus, with reference to the drawing, and at the same time show its application to distillation; and afterwards explain its adaptation to other purposes, namely, for evaporating

the solutions of salt and sugar, necessary in the manufacture of those articles; for generating steam for motive engines; for the acetifying of vinegar; and for the manufacture of verdigris.

"First, as to distillation; *a*, fig. 1, is a tall cylindrical vessel containing the fermented *wash* to be distilled, which vessel is supposed to be regularly supplied by means of a pipe from the brewhouse. By turning the cock in the pipe *b*, the wash flows upon the *exterior* surface of the conical evaporator *c;* the liquid is first discharged into a small basin fixed round the cone near to its apex; which basin, having numerous minute perforations at the bottom, distributes the liquid equally over the whole surface of the evaporator in the thinnest possible stratum. The quantity of wash allowed to flow, may of course be regulated by the turning of the cock, and its uniform distribution may be assisted, if necessary, by spreading thin linen cloth, or wire gauze, (each has its peculiar advantages) over the surface of the cone, which would quickly absorb, or prevent the liquid running off too freely; *i. e.* before the required degree of vaporization was accomplished.

"The evaporating cone, I propose to be made of thin copper, and to be heated in that way which may be found the most convenient and economical; the means depending upon the circumstances of its locality. In the drawing, I have broken away the front of the cone, to show that it is hollow, and equally adapted to the application of heat to its surface, whether by direct fire, by heated air, or by steam. If by direct fire, a *very* small stove may be placed on the centre of its circular floor, and immediately over it, an aperture, or tube, for the supply of atmospheric air; the flue should descend, or an aperture should be made at the lower part of the side of the cone, in order that the upper part may be constantly preserved at the necessary temperature; the heated air having no tendency to descend and to pass off by the flue, nearly the whole of its caloric, would be usefully applied. If the tube which supplies the air were to pass through the brewhouse furnace, there would probably be no occasion for employing the stove before mentioned, when the furnace was in use, as hot air of sufficient intensity would occupy the upper part of the cone; the heat requisite being below that of boiling water. Should steam heat be desired, which is preferable on account of its easy regulation, it might be brought on from the brewhouse copper, by means similar to those described, and the condensed portion might run back into the boiler through the same pipe which conveyed the steam. But whatever may be the medium by which the heat is introduced, I apprehend that its application by this contrivance, will be more economical and effective for the purpose of vaporization, than any which has preceded it.

"I propose that the evaporating cone, be not heated to a higher temperature than 180° Faht.; to ascertain which, I would have a thermometer fixed in a convenient situation; and I would regulate the temperature by the turning of a cock, which would admit a greater or less quantity of steam. At the temperature mentioned, but a very small portion of aqueous vapour would be raised along with the

spirituous; and by that means I would also separate the spirit, at the commencement of the process, from those matters which usually contaminate spirits of home manufacture. That portion of the wash that, owing to the low heat, escapes evaporation, (which would consist chiefly of water and extractive matter,) will run off at the bottom of the cone, along a circular gutter, and from thence pass out by an aperture or pipe, as at *e*; while the more spirituous, rises between the inner and outer cone *f f*, enters the neck *g*, and from thence proceeding through the spiral worm shown in the wash vat *a*,* is received into the recipient *h*, partly in the form of vapour, and partly in the liquid state.

"The more volatile portion of the vapour passes onward through the open tube *i*, into the great refrigeratory *k*. This is a large cylindrical vessel or vat, with a strong false bottom at *l*; on this rests a metallic apparatus, consisting of a great number of small tubes *t t*, open at each end, and fixed parallel to each other in a vertical position; their lower ends being soldered into a metallic bottom, and passing through it: the upper ends of the tubes, in like manner, are soldered and pass through the concave plate in the chamber *m*. This metallic apparatus being luted or soldered to the false bottom round its lower edge, all the vat above the false bottom *l* is kept filled with cold water by a service pipe inserted at the lower part. The vapour therefore passing through perforations in the false botton, rises up the numerous small metal tubes, by which it is separated into very narrow columns (into wires of vapour, if the term may be allowed,) and being thus exposed in metallic conductors to the powerful influence of the mass of surrounding cold water, its caloric will be very rapidly abstracted; the condensed liquid, which then runs back down the pipes, meets with the rising vapour in its progress, and by that means condenses a further portion at a higher temperature than would otherwise have been accomplished. I mention this circumstance here, to explain the reason, why I allow the vapour to proceed upwards, instead of forcing it downwards, according to the ordinary practice, which alteration I think may be deemed an improvement. By these arrangements I expect that very little vapour will reach the upper chamber *m*, if the temperature of the water is not allowed to get above 80°; but if the supply of cold water should be insufficient for the purpose, the vapour must of course proceed from the tube *n* to another refrigeratory.

"It is deserving of notice, that in this apparatus the process may be continued without stopping, as long as the fermented wash is sup-

* The passing of the vapour through the vat *a*, has three advantages; the *first*, that of condensing a portion of the spirituous vapour; the *second*, the raising the temperature of the wash to about 160 degrees, so that it is discharged upon the still already in a heated state, and a very slight increase of temperature is sufficient to separate all its alcoholic constituents: the third results from the second; as the temperature will thus be raised to 160°, a very strong spirituous vapour will slowly collect in the upper part of the vat *a*, which may be conducted off by the tube *o*, into a separate recipient or refrigeratory, as the spirits thus produced will be of superior purity.

plied from the brewhouse, which is not the case with any other still. If it be required at any time to have access to the inner cone, a door made on the outer one (which should be kept luted during distillation,) will answer this purpose effectually.

"I have proposed to cover the inner cone with cloth of some kind; this might be laid on in longitudinal sections, each piece forming an isosceles triangle, and stretched out to that figure by a stiff wire, which should also be curved to fit the convexity of the cone. These pieces might then be readily taken out at any time, and the deposit washed away, or others put in their places. If these triangular cloths were made of metallic gauze, it is probable the evaporation would be much expedited. It would, however, be desirable to do without these appendages, entirely; if the surface of the cone was slightly indented or grooved, the liquid might then be distributed evenly without the cloth, and be detained a sufficient time to complete the operations. There are several obvious modes of treating these points, which it would be tedious to describe, or to read. I shall, therefore, conclude the subject, as regards distillation, by explaining the use of the apparatus attached to the winch *p*. This winch is fixed upon the axis of a small bevelled pinion; this pinion turns a bevelled wheel *q*, which revolves round the upper part of the cone (against friction rollers,) and carries with it two long bars *r r*, the edges of which scrape or brush against the surface of the cone, to clear it of sediment or incrustations, which will then fall to the bottom: the bars *r r* are connected by a ring at *s*. Such an apparatus will be useful in the distillation of liquids that contain much extractive matter.

"Having concluded my observations upon the apparatus as a still, I proceed to notice its application to other purposes. For evaporation simply, the refrigeratory part of the apparatus is of course to be entirely dispensed with. In evaporating brine for obtaining salt, the double cones appear to me to be infinitely preferable to the immense open pans generally used in Cheshire and other parts. The salt makers proceed upon the improved plan of exposing an extended surface; accordingly, each of their pans measures several hundred superficial feet, and they are filled with the briny liquid to the depth of a foot or more. Now if the principle of extension of surface be right, which appears to be acknowledged by all scientific men, *the greatest extent to which the principle can be carried must have the preference.* Again, it is a most erroneous plan to expose the evaporating surface to the air, which of itself produces a considerable condensation, causing a portion of the vapour to fall down again into the pans, in the state of fine rain. Reason tells us that this must be the case: but the French have done more for us; they *proved*, many years ago, by direct experiment, that evaporation does not proceed so rapidly in uncovered vessels, as in those which are covered, with a pipe to convey off the steam. To complete the apparatus for the preparation of salt, the scrapers *r r*, already described, would be found particularly efficient and convenient.

In the concentration of vegetable solutions generally, but in particular that of sugar, my evaporating cones appear to me to have a

decided preference over the open pans, commonly used in the West Indies and elsewhere. In the successive evaporations which the sirop undergoes, previous to the crystallizing process, the liquid is ladled from one vessel to another: in my apparatus this trouble is entirely dispensed with, the liquid continually running off, of itself. In the consumption of fuel, I conceive, there would be a considerable saving, as the caloric is applied with greater effect, and more economically, than by the usual furnaces; and the condensation of the vapour back into the sirop is prevented, by my external cone or covering, which excludes the evaporating surfaces from the air. My scrapers would also be applied very effectually in removing any incrustations that might form on the surface of the inner cone. The cones might be made of any magnitude, or several might be arranged a little above one another.

For the generation of steam for motive engines, I see no difficulty in its application; for that purpose, the rapid and economical production of vapour in strong vessels appears to me all that is required. I need not repeat that my extended surface and mode of applying heat would produce vapour with great rapidity; and it is obvious that the conical form offers great strength. For low pressure steam, a very thin internal cone would do; and for high pressure, a very thick one would not be necessary; as the expansive force would be exerted in that direction where the vessel was strongest: the exterior cone should however be of greater strength than the interior one, yet of a less substance than boilers in ordinary use; and it would be attended with this further advantage, that in case of the exterior cone bursting, very little damage would result; there would be no hot water to scald, nor any masonry to be blown up, or building destroyed in consequence.

In the preparation of Vinegar, it is a commonly received opinion, and I presume a correct one, that the acid property of the liquid is derived from its absorption of oxygen; the operation usually consists in exposing the liquid under fermentation, in open, or imperfectly closed, vessels, to the atmosphere. Now it has been found, that the oftener the surfaces of the liquid are changed, by agitation, or by ladling or pumping it out of one vessel into another, the sooner the vinegar is formed. The acidifying principle being thus obtained, it appears to me to follow, that that apparatus must be the best for the purpose, by which the most extended surface of liquid can be conveniently exposed to the influence of the atmosphere; accordingly I venture to propose my cones, before described, for this purpose also, but under certain modifications. First, I would have made a series of cones (of the cheapest materials) and of such relative dimensions, that they may be enclosed concentrically one within another, a few inches apart: the liquid in the thinnest possible strata, might then be allowed to flow over them, by similar means to that described in the first part of my letter. The effect of this arrangement would I think be a very rapid absorption of oxygen, or in other words, the speedy forming of the vinegar. By the plan described, I have supposed the cones to be open at top and bottom, for the air to circulate between them. It might *possibly* be an improvement to let all these cones

terminate or open into one common tube; the air in which tube might be exhausted, by any convenient means, so as to increase the draft. An obvious and an inexpensive mode of producing this effect would be to supply the furnace with air for the combustion, from this tube, by which means a rapid current of air between the cones would be promoted. In vinegar manufactories a large furnace is almost always employed, whether in distilling the acid from wood, or in making a solution of malt.

Verdigris, as is well known, is a combination of the acetic acid with the oxide of copper: it is usually prepared by frequently wetting the surfaces of copper plates with vinegar, by various media, and when the copper becomes sufficiently coated with the green oxide, it is scraped off, and put into bags for sale. This operation is usually performed by removing the copper plates, (which are about 12 inches square,) from the racks in which they are laid, and the plates are, one by one, scraped with an instrument made for the purpose. The copper plates used are generally very light, weighing about 16 ounces to the superficial foot; I would use copper of much greater thickness, in constructing my cones, and place several of them concentrically one within the other; each of the cones should be provided with a pair of scrapers, and the bevelled wheel and pinion before mentioned, so that I might act upon them all by the turning round of one spindle; thus the verdigris, covering several very extended surfaces, might be scraped off *in a few seconds*. The cones would last a considerable time, as the metallic portion of verdigris is but a small component part of it.

ENGLISH PATENTS.

Account and description of Evans's patent distilling apparatus.

We shall introduce our description of Mr. Evans's New Apparatus, by which he proposes to remedy the defects of the old system, by inserting some observations made upon it, by the intelligent Editor of the Monthly Magazine, which appeared in July last; the invention is there announced in the following terms.

"Mr. Evans has constructed the model of a still, upon a new principle, which, if it answer on a large scale, will altogether supersede the old alembic. The theory of the machine is such, that it may, without hesitation, be pronounced the most decided improvement hitherto effected; for, if we mistake not, the still at present in use, remains in principle precisely the same, through the operation of the excise laws, that it was a century ago. Whatever improvements have been attempted, apply only to the rectification, while the first formation of the spirit is conducted in the same rude manner as in the infancy of science. We forbear entering into a more particular description, until the design be carried into execution upon a large scale. We should be extremely sorry, by premature publicity, to afford the continental distillers an opportunity of maintaining the superiority they have hitherto enjoyed, and we feel convinced, that

we shall now take the lead in this important branch of our productive industry. The new apparatus, eminently combines economy in practice, and simplicity in construction; but the most valuable attainment, is the production of pure untainted spirits, which may be drawn in one operation, at any point of strength."

We have made such a drawing of the apparatus, as to show the whole operation at one view; *a* is a pipe which conveys the 'wash' or fermented liquor into a reservoir *b*, where it is maintained at a certain level, by the ball valve *c*. *d* is the still, which is a revolving copper cylinder, with ledges fixed in horizontal lines against the inner surface, to increase the agitation of the wash, as it turns upon its hollow axis, *f g:* its motion is derived from the spur wheel *h*, acting upon the pinion *i*, fixed on the hollow axis *f*. *j*, is the rectifier; this is formed of a large pipe of uniform bore, coiled up into the spiral figure exhibited, with the ends bent, so as to form axes for rotation, on one of which, a pinion *k* (corresponding with that at *i*,) is fixed, and this pinion is acted upon by another spur wheel *l*, on the same shaft as the other: *m* is the common distiller's refrigeratory, and *n* a receiver for the distilled spirit. The figure represented in dotted lines, is intended to show the position in which the still is drawn up, when it is necessary to cleanse it; for this purpose, there is at *o*, a universal joint of a peculiar construction, which enables it to be easily done, after having separated the connected tubes at the union joint, represented contiguous thereto.

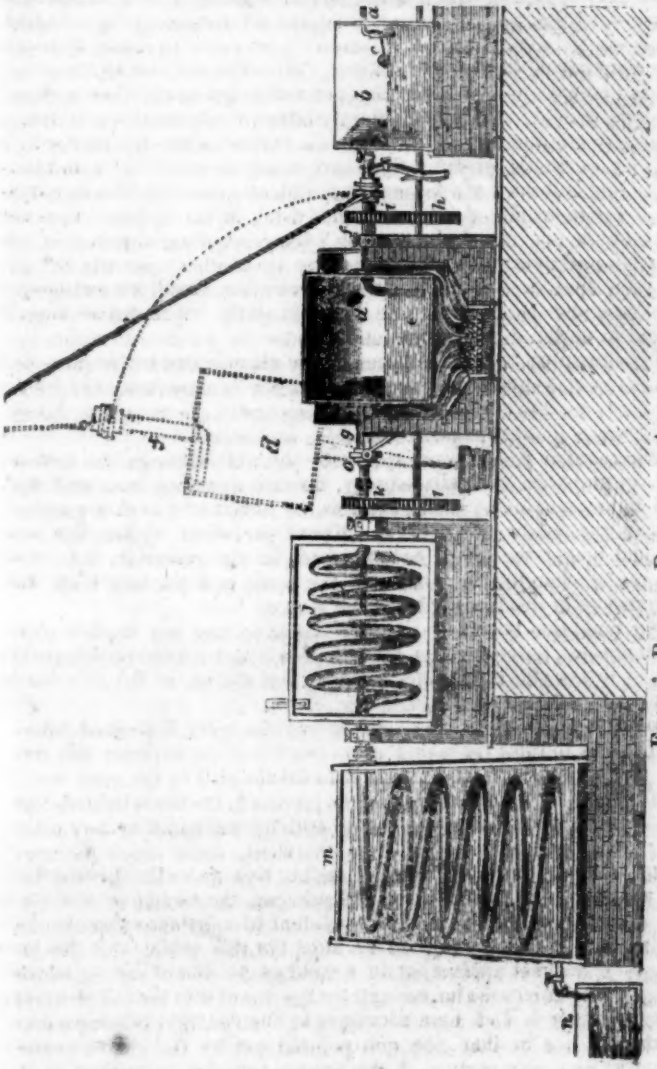
The rectifier *j*, communicates with the still, through the hollow axle *g*, and with the refrigeratory, through a stuffing box; and the still communicates with the reservoir, by means of a syphon passing through the hollow axis *f*. The outward part of the syphon has two unequal limbs; the short limb inserted in the reservoir, is for the purpose of charging the still with the wash, and the long limb, for the purpose of discharging the spent liquor.

The operation is one of singular elegance, and our readers will, we doubt not, agree with us, that the novel and simple contrivances by which it is effected, evince a mechanical genius in the contriver, of no ordinary description.

In order to charge the still, the ball of the valve is pressed downward, so as to raise the liquid above the top of the syphon; this sets the syphon in action, and causes it to fill the still to the same level, as the liquid in the reservoir. Thus prepared, the fire is lighted, and a slow rotatory motion given to the still by the hand, or any other convenient first mover, applied to the shaft, upon which the spur wheels *h* and *l* are fixed. It matters not how fierce the fire may be, the continuous motion of the liquid prevents the formation of empyreuma, and those other ill effects incident to spirituous liquids in a fixed boiler. The agitation of the liquid in this vessel, and the intensity of the heat applied, cause a rapid production of vapour, which immediately enters the hollow axis *g*, and passes into the coiled worm of the rectifier *j*. It is here necessary to observe, that this capacious worm revolves in that direction pointed out by the arrow, consequently, whatever portion of the vapour becomes condensed in it,

runs out at every revolution, back through the hollow axis *g*, into the still; and the hollow axis *g* is, for this purpose, made tapering wider towards the still, so as to give the liquid a descent to run freely into it.

The vessel *j* is, therefore, properly termed a rectifier, as it sepa-



EVANS'S PATENT DISTILLING APPARATUS.

rates the water from the diluted alcohol, before passing out of it into the refrigeratory *m;* in this, it arrives in a state more or less concentrated, according to the temperature preserved in the rectifier, which is regulated, as usual, by a thermometer; the spirit may, consequently, be drawn at one operation of almost any required strength.

A very interesting feature in these new arrangements, is the mode of applying the syphon; which is constantly supplying the still with fresh wash, in place of that which has been vaporized, and this operation is uniformly continued during the rotation of the vessel, owing to its passing through a tubular axis: the syphon, in like manner, enables the still to be discharged without stopping the machinery. When it is necessary to re-charge the still with the fire under it, a thick cast-iron sliding plate is drawn from the back, so as to interpose itself between the fire and the still, and thus prevent any injurious effects to the contents of the latter. When fuel that does not emit much smoke, such as coke, or anthracite, is employed, the grate itself may be drawn out from under the still, by placing it upon castors, or rollers, and without inconvenience, as the time necessary to renew the operation of charging, sufficiently to prevent burning, is only the work of a few moments.

We shall here close our remarks, by acquainting our readers that this invention does not emanate from the wild speculations of a mere theorist; for Mr. Evans is an inquiring practical man; and his observations, and his experiments, have convinced him that alcohol is *not* altogether the result of the vinous fermentation, but *the product of a subsequent elementary change*, effected at a higher temperature, which hitherto could not be ascertained, for the want of an apparatus such as we have described. Upon Mr. Evans's principle of construction, any temperature may be uniformly applied to the whole mass of liquor; while by the old vessels this is impossible to be done, without injury to the products, for reasons before given.

It is likewise particularly deserving of notice, that there is a considerable economy in the application of heat by this method, for the fire acts uniformly upon the whole of the surface of the still, but in those of the ordinary construction, the fire does not act upon more than one-third, or one-fourth of the surface. [*Register of the Arts.*

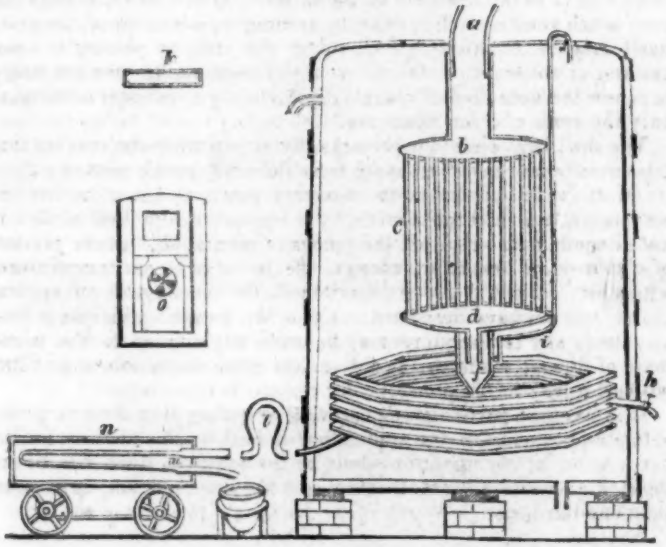
Williams's Patent Apparatus for Distillation.

THE improvements projected under this patent are comprised under the following heads; viz. an enlarged capacity of the still-head, to cause a separation of the aqueous vapour by condensation, previous to its passing over the neck of the still, into the spirit condenser; in the employment of numerous small vertical tubes surrounded with cold water, to increase and accelerate the condensation; in the adaptation of a peculiarly constructed "cooling worm," by which, it is conceived, the quantity of spirit will be increased by preventing evaporation in its progress to, and when in the receiver;

and in the employment of refrigerating saline mixtures, for the more effectual cooling of the spirit in warm climates, or in warm weather.

This invention has been patented about six years, which circumstance gives it greater claims upon our admiration, than if it were the invention of this precise period of time, so fraught with great improvements in the art of distillation; many of which, however, appear to us to have been indebted in a great degree, to this fine example.

In the body of the still, (that part where the vapour is generated) there is no improvement proposed, but an enlarged capacity of its globular head, to cause the watery particles to fall back into the still; this part of the apparatus we have omitted in our diagram, as it requires no additional explanation; the engraving, therefore, relates wholly to the apparatus for condensation.



a is the termination of the neck of the still which conveys the vapour into the "upper drum" *b*, whence it is divided among a number of small vertical tubes *c*, which the patentee says, should not exceed $\frac{3}{4}$ of an inch in their interior diameter. As the tub inclosing this apparatus is filled with cold water, the condensation immediately commences in the upper drum, and is completed in its subsequent progress through the vertical tubes, and the "lower drum" *d*. From thence, the fluid runs down a central neck *e*, into the trap *f*, from the upper part of which trap it enters the cooling worm *g*. It is evident that the trap *f* is, in working, always partly filled with liquid, and the neck *e* being immersed therein, any vapour which may have escaped condensation can pass no further. The trap *f* has a

funnel-shaped bottom, from which a pipe *h* passes through the coils of the worm, and through the side of the tub, where it is furnished with a cock, for the purpose of drawing off any impure spirit, which may be separated from the wash in the first stage of the process; and to discharge what may remain in the trap when the process is over. To the trap *f* is also attached another pipe *i*, called the safety pipe, for the purpose of allowing "the egress and ingress of atmospheric air, from, and to, the condenser, to prevent both pressure, and a vacuum, therein." The coils of the cooling worm are made octangular; the worm itself is made flat, and of considerable breadth: a transverse section of it is exhibited in the separate figure *k*, which shows it to be in the form of a parallelogram, whose longest sides are four inches, and its shortest half an inch wide. This octangular worm, after making six complete turns, assumes a circular shape and diverges off to pass through the side of the tub; at its end, outside the tub, which is made a little tapering, is fitted, and is to be occasionally applied, a crane-necked pipe *l*, which pipe may be elevated or depressed at pleasure, for the purpose of keeping three or more of the coils of the worm full of liquid. This crane-necked pipe is intended to be applied in hot weather, or hot climates, to cool the spirits more effectually, and prevent their evaporation, by subjecting the same in a greater degree to the effect of the cold water in the worm tub.

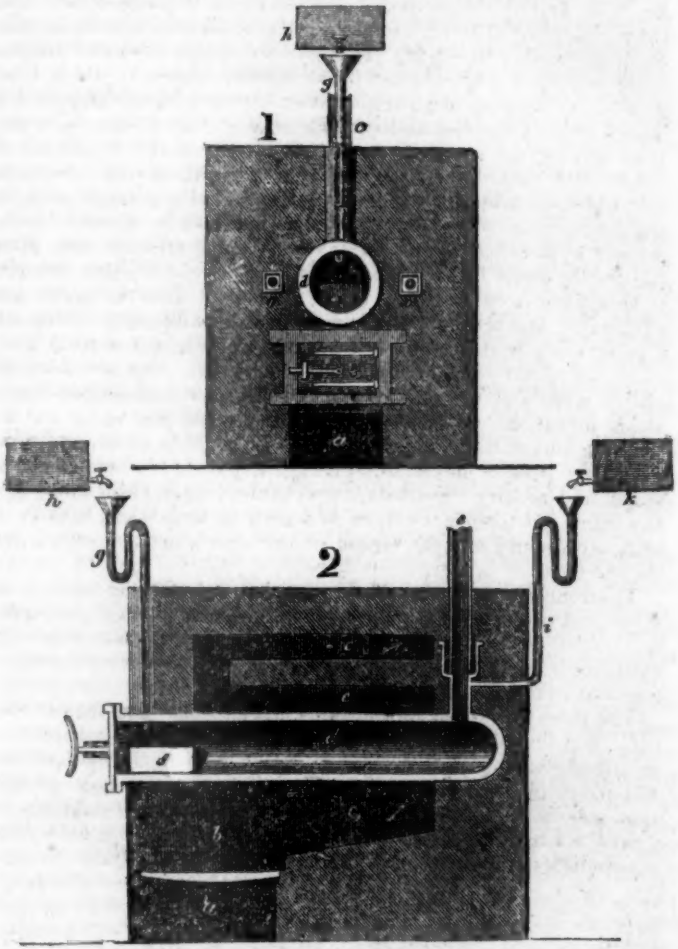
An additional apparatus to be used in hot climates, of undoubted utility, is likewise recommended by the patentee, and claimed by him as his invention. It consists of another pipe *m*, into which the discharging end of the crane-necked pipe is made to enter, and which pipe, after passing the end of the trough *n*, is made of a very broad flat shape, and running the whole length of the trough, (which may be of any extent;) it is then to return by a very slight descent, so as to run back very gently into the funnel of the pipe which conveys it into the receiver.

The trough *n* may be supplied with Glauber's salts and nitre, or any saline mixture capable of producing intense cold, for the more effectual cooling of the spirit; the trough may be placed upon wheels and axles, for the convenience of bringing it to, and conveying it from, its required situation.

The patentee further recommends, but does *not* claim it as a patent right, that the ash-pit of this still, as well as of stills generally, be furnished with a plate iron door, in which is to be introduced near its top, one or more registers, as shown in the separate figure at *o*, the apertures in which may be closed, more or less, to produce the required draught, and thereby enable the distiller to check, or increase, the ebullition at pleasure, and with the greatest facility.

Gas Apparatus.

Account of the apparatus for which a patent has been obtained by Wm. Vere, engineer, and Henry S. Crane, manufacturing Chemist, for improvements in the manufacture of Gas for illumination; and especially for the decomposition of coal tar for that purpose.



In the generation of sub-carburetted hydrogen gas, from coal, great inconvenience has been sustained by the deposition of adhesive matters in the pipes leading from the retorts, by which they gradually

became choked up; it, in consequence, became frequently necessary to suspend the process, for the purpose of clearing out the deposit. A considerable quantity of tar is also obtained as a separate product in the gas manufactories; in some of them, this tar was afterwards decomposed, for the purpose of generating gas, (which it yields in considerable quantity) but it was discovered, that the tar, thus employed, caused a greater evil in the pipes by a deposition of asphaltum, which quickly rendered them unserviceable: besides this, it was found that the gas produced from this material afforded but a feeble light, and emitted much smoke: for these reasons, the decomposition of coal tar was discontinued in most manufactories.

As a remedy for these evils, Messrs. Vere and Crane have devised the invention delineated in the accompanying engraving. The specification states the apparatus to be applicable to the distillation of coal, coal-tar, tar-oil, oil, vegetable oil, animal oil, and all other solid or liquid matters, from which carburetted hydrogen may be obtained; and the process consists in introducing a constant stream of water into the retort, or a current of steam into the exit pipe; which, mixing with the volatile matters, as they rise from the substance under decomposition, causes them to fall down again into the retort, without proceeding further to choke up the pipes, while the more gaseous products pass on through the steam, in a more pure state, to be afterwards treated in the usual way. The gas obtained from tar by this process, is said to burn with a brilliant white flame, instead of the dull, smoky light, as before mentioned.

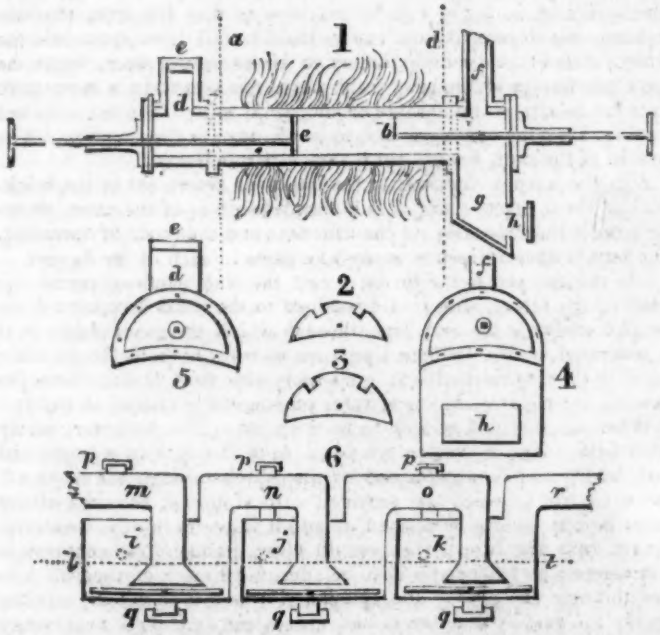
Fig. 1 is a front elevation of the improved retort, set in the brick-work of the furnace. *Fig.* 2 is a vertical section of the same, showing more advantageously its construction, and the mode of operating. The letters have reference to the like parts in each of the figures.

a is the ash pit, *b* the furnace, *c c c* the flue winding round the retort; *d* the retort, with its lid fastened in the usual way, by a cross bar and screw; *e* the exit pipe, through which the gas escapes as it is generated; *f* is a wrought-iron pan, or tray, to hold tar, or other liquid matter to be distilled; *g* a supply pipe to *f*, leading from the cistern, or reservoir, *h*; *i* is a water pipe, and *k* a cistern of water.

When tar, for instance, is to be operated upon, the retort partly filled with coke, or broken bricks, is to be brought to a bright red heat, which may be ascertained by inspection through the holes *o o*, shown in *fig.* 1, which are provided with stoppers; the cock of the water pipe is then to be opened, to admit water to flow, in a slender stream, into the retort, the heat of which immediately converts it into vapour: this done, tar is to be admitted from the reservoir *h* to flow through the pipe *g* into the pan *f*, where it is quickly decomposed; the gas, as it ascends and enters the exit pipe, necessarily passes through a large volume of steam, which causes an instant precipitation of the carbonaceous matters, which would otherwise lodge in the pipes, and ultimately obstruct the passage of the gas through them. The gas, thus relieved of the principal contaminating matters, has then to pass through the ordinary purifications, by which it is ultimately brought to a state of great purity, for consumption.

When coal, or other solid matters, are to be decomposed, for obtaining the gas, the pan *f*, the pipe *g*, and the reservoir *h*, are to be removed, and the operation is to be conducted without them; retaining, however, the use of a current of steam, as in the former case. The quantity of water required for this purpose, will depend upon the nature of the material under distillation; but, in general, eight or ten gallons of water to 1000 cubic feet of gas will be found adequate to the precipitation of the carbonaceous matter. The stream of water should of course be constant and uniform; and it would be desirable to introduce a current of steam from an engine boiler, if there be one on the premises, in lieu of the water, especially when operating upon coal.

Description of the apparatus for obtaining, and purifying, gas from coal, for which a patent was obtained by Mr. Hobbins, Ironmonger.



THE accompanying drawings represent a new construction of retorts for the generation of the gas, and an improved apparatus for its subsequent purification. The advantages expected to result from these arrangements are, first, an increased facility in charging the retorts with coal, and afterwards in discharging them of the coke

resulting from the separation of the gas, thereby considerably reducing the labour of the stoker, or attendant of the fire. Secondly, in affording a simple and ready means of spreading the coal over the retort, in a thin uniform stratum, thereby equalizing the temperature of the coal throughout, rendering the luting of the joints unnecessary, and causing a speedy separation of the gaseous products; the whole operation requiring but ten minutes. The purifying vessels adopted by the patentee are of two different constructions, but both are in principle, somewhat similar to a Woulf's Distillatory Apparatus; in them, the gas is made to pass successively, through several vessels, charged with lime or other purifying materials, and the chemical action which takes place from the contact of the gas, produces a constant agitation, without the necessity of resorting, as usual, to mechanical aid.

Fig. 1 shows a longitudinal section of a retort, supposed to be placed in the furnace, occupying the space between the two dotted lines *a a;* the two ends of the retort are flanched on to the body, and projecting beyond the brickwork, are removed from the influence of the fire. *b* and *c* are two scrapers, with long rods attached to them, which pass through the flanched ends of the retort, and have cross handles at their extremities; as the scrapers have to be pushed the whole length of the retort, the rods should be about a foot longer than the latter; as this proportional length is not shown in the engraving, they are exhibited as broken off near to the handles. The form of the scraper *b* is shown by the separate figure 2, and the form of *c* by the separate figure 3; in each of them are two square notches, which sliding upon square bars of iron placed longitudinally on the upper side of the interior of the retorts, are thereby suspended to it, and kept uniformly in their proper positions.

The process of working the retort is as follows:—Previous to charging it, the scraper *c* is drawn outwards from the body of the retort close up to the end, and the scraper *b* is pushed inwards so as to come in contact with *c*; both scrapers being then beyond the opening *d*, the charge of coals is admitted through the latter, by opening the cover *e*, which may turn upon a hinge joint, or be lifted up by means of a pulley and counter weight. The scraper *c* is then drawn back from its recent situation (beyond *d*,) which spreads the coals out in an even layer, all over the bottom of that part of the retort exposed to the action of the fire. About a foot from each scraper, the rods are connected by a solid and hollow screw, so that when the rods are drawn out, they may be removed out of the way by unscrewing them at those parts. As the distillation of the coal proceeds, the gas escapes by the tube *f*, and from thence to the purifying vessels. When all the gas has been separated from one charge of coals, the scraper *c* is thrust forward, pushing before it and clearing out all the coke, which falls into the coke-box *g*, previously closed by the mouth-piece *h;* from this receptacle, the coke may be afterwards let to fall into a barrow, and be wheeled away.

As it necessary that the apertures for the admission of the coal, and the discharge of the coke, should be closed air-tight; the paten-

tee has availed himself of the distant, or screened, situation of these parts from the heat of the furnace, to adapt a lining of lead to the covers, by which means they are closed as effectually as by the troublesome process of luting the joints at every charge. To recharge the retort, both the scrapers are again thrust back beyond the opening *d*, when a similar quantity of coals is admitted, which are spread out again in an even layer, by drawing back the scraper *b*, and the distillation re-commences. The process is in this manner repeated as long as the production of gas may be required.

It should be noticed, that the ends are connected to the body of the retorts by flanches screwed together, so that when the furnace has destroyed the latter, a new one may be screwed on to the ends of the old retort, at a comparatively little cost, instead of having them wholly new. From each end of the retort, a tube projects horizontally, about ten inches long, and one inch in the bore, which serves both as a support, and a guide, for the scraper rod which slides through it.

Fig. 4 gives an external view of that end of the retort where the coke is discharged, and *fig.* 5 a similar view of the other end of the same, where the coals are received: the letters have reference to the like parts in each of the figures.

The purifying vessels proposed by the patentee, are of two descriptions; we have selected that for our engraving which we consider to be the best, but shall give some account of the other.

Fig. 6 gives a vertical section of a series of three vessels, *i j k*, the lower parts of which, up to the dotted line *l l*, are occupied with a stratum of lime, or other purifying material. The impure gas from the retort is first received into the tube *m*, and by its pressure descending along the bent arm, it passes out of the expanded, or bell-mouthed, end, where it mixes with the lime in the vessel *i*, and deposits therein much of its impurity, by condensation; from this vessel, the gas again rises and enters the tube *n*, from thence, filtering through the lime in the vessel *j*, it re-ascends, and enters by the tube *o*, into the third filtering vessel *k*. The pressure upon the gas being constant, the filtration may be repeated through any number of these vessels, but the extent of the process already described will, in general, be sufficient to produce gas of great purity; in which case it would be conducted by the tube *r* to the gas-holder, for subsequent distribution.

The three covered tubes *p p p*, above the filtering vessels, are for the purpose of charging them with the lime; the dotted circles are perforations in the sides of the vessels (furnished with plugs,) for ascertaining the depth of the stratum of lime, &c.; and the three tubes *q q q* at the bottoms of the vessels, are for discharging the lime when saturated with the various matters that have been condensed during the process of filtration. To aid the complete discharge or clearing of these vessels of their contents, three bars of iron are employed as scrapers, one in each vessel, and nearly of the same length; a rod, as a handle, is screwed into each, which passes through a hole (provided with a stuffing box) in the side of each vessel.

The other form of purifying vessels, proposed by the patentee, will, perhaps, be understood by the following description. A large cylindrical basin is divided internally by a series of circular partitions, placed concentrically; on the bottom of the whole, the stratum of lime, or other matter, is laid. Over these partitions are placed in an inverted position, a number of circular vessels one within another, and arranged alternately between the partitions, with their edges imbedded in the layer of lime. The gas, which enters by a tube through the centre of the bottom of the larger exterior vessel, first ascends over the innermost partition, and thence descending by the interposition of the bottom of the innermost inverted vessel, it is compelled to enter the first portion of the stratum of lime; having filtrated through this, it passes up between the outside of the inverted vessel and the next partition; passing over this, it descends on the other side of the last-mentioned, and enters a fresh portion of lime; and so on, from compartment to compartment, until the purification of the gas is completed, when it is conducted into the gas-holder ready for the purposes of illumination.

GAS AND VAPOUR ENGINES.

Some remarks upon explosion and vapour engines. By the EDITOR.

IT is now upwards of three years, since Mr. Samuel Brown's gas engine was introduced to public attention; and from the ingenuity of its construction, and the sanguine expectations of the projector, and some of his friends, it excited an unusual degree of interest. The principle of its action was by no means novel, the production of a partial vacuum by the combination of explosive mixtures of atmospheric and inflammable air, had been long spoken of, as a substitute for that power obtained by steam. In the year 1814, a model of an engine acting upon this principle, was placed in the hands of the Editor, with a view to his instituting some experiments with it. The inflammable gas to supply it, was to be obtained from the charring of wood; and it was imagined, that the charcoal produced, would go far in defraying the expense of working it. The model was rudely made, but appeared to work with considerable power, and the subject would have been pursued, but for the removal of the Editor to Virginia, on which account the model was returned to the inventor, and it is believed that no further effort was made to perfect it, and thus, the time and money which would probably have been uselessly expended upon it, were saved.

Since that period, several attempts have been made to apply the same principle, either by using inflammable gases, or the vapour from fluids which are volatile, and combustible; hitherto, however, these efforts have been unsuccessful, and we have strong doubts, whether under any ordinary circumstances, an engine operated upon by an explosive mixture of gas, or vapour, will ever be constructed, which will successfully compete with the steam engine.

The want of success, which has attended the ingenious and perse-

vering efforts of Mr. Brown, renders it less necessary to urge our objections, than it would have been two or three years ago. There does not appear, in the successive attempts to perfect this engine, any deficiency of genius, perseverance, or funds; and yet, so far, we believe, it must be pronounced to be a failure. One of the main difficulties which has been experienced, has arisen from the large quantity of gas consumed, which has, to an enormous extent, exceeded the calculations originally made; such at least is the information which we have received, and that, from sources entitled to credit.

Having in our possession an engraving of Mr. Brown's engine, as constructed by him in the year 1824, and as we are not aware that its structure has been exhibited in any of our Journals, or in any other work published here, excepting Nicholson's Operative Mechanic, we have determined to insert the engraving, and description, which we doubt not will be acceptable to our readers. We have spoken of this engine as a failure; we ought, however, to state, that such is not the opinion of the inventor: an engine upon Mr. Brown's principle has recently been constructed in this city, by his son, who came from England for that purpose, under the patronage of one of our most respectable fellow citizens. This engine, although not actually completed, is so far so, as to have been set in operation; the question of its value, in the form it has now assumed, will, therefore, soon be settled. Mr. Morey is also here, with the design of completing one of his explosive engines, an account of which we formerly published. This, in its structure, differs considerably from Brown's; it has two cylinders with pistons; these cylinders are alternately filled with air, and vapour from heated spirits of turpentine; this mixture when ignited by a taper, explodes, expelling nearly all the air through an opening in the bottom of the cylinder, which bottom is formed of leather, in such a way that it operates as a large valve, allowing free exit to the heated and expanded air, and closing so as to prevent its return; the pressure of the atmosphere operates upon each piston, alternately, as it would in an ordinary atmospheric engine with two cylinders.

Engines, analogous in principle to the ordinary steam engine, but acted upon by the elastic force of vapour from different volatile liquids, have also been constructed, or proposed; and several patents have been obtained for them. The objections to these, appear to us to be insuperable; for although there is no theoretical obstacle in the way of their operation, the practical difficulties which present themselves, have hitherto caused, and are likely to insure, the abandonment of all such attempts; whenever we meet with accounts of such in the journals, we expect the same fate to attend them, which we know await those numerous advertised *improvements* which sin against the established laws of nature; not that we esteem them alike absurd; alcohol, ether, quicksilver, or any other volatile fluid, may be used to work an engine; the attempt, therefore, to employ them, is a legitimate object of pursuit, its attainment is within the bounds of possibility, and although it may ultimately fail, the effort may yet reflect great credit on the individual who makes it.

One of the vapour engines for which a patent has been obtained in England, will be found figured and described after that of Brown; we do not deem it necessary to make any particular remarks upon its structure, as our objections are of a general nature, resulting from the unavoidable defects in workmanship, and the necessary consequences of wear, and derangement, incident to all machines, and particularly to those which are massive.

Description of Mr. Brown's engine, in that form of it in which it was intended to raise water, which afterwards flowing upon an overshot water wheel, was to give motion to machinery.

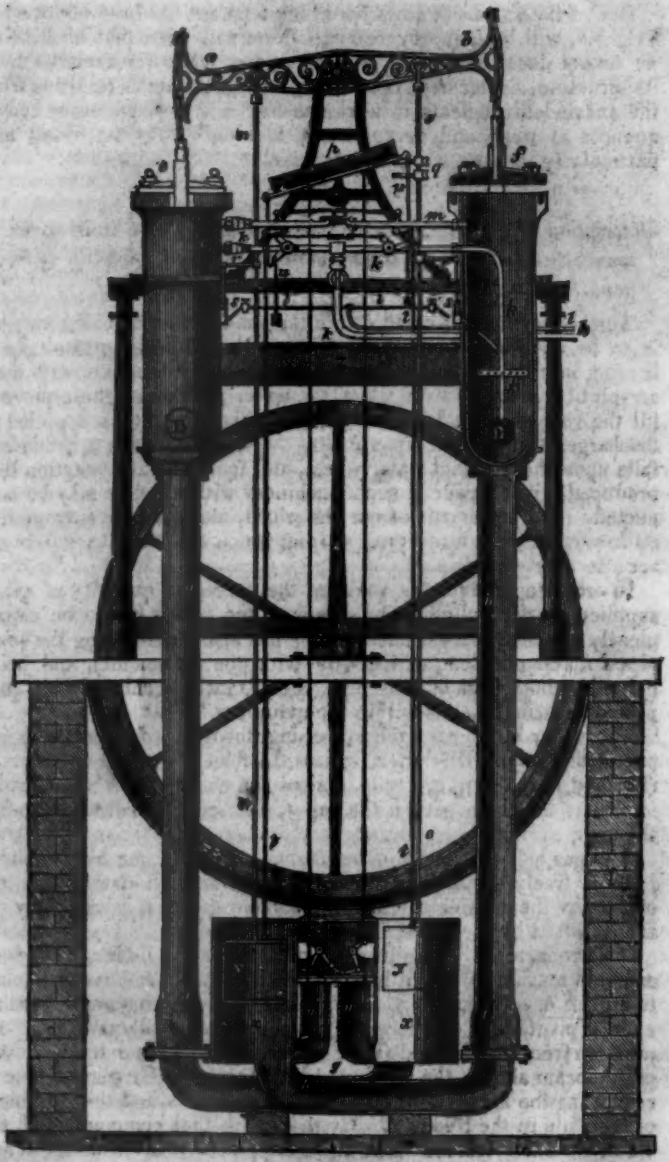
The two cylinders, *c* and *d*, are the vessels in which the vacuum is to be obtained; from these descend the pipes *g i g* and *h j h*, leading into the lower cylinders *x x*, which communicate with a reservoir of water, and from which the water rises along those pipes to fill the vacuum cylinders alternately. The water thus supplied is discharged through the pipes B into the tank or trough *z*, whence it falls upon the overshot water-wheel, and by the rotatory motion thus produced, gives power to such machinery with which it may be connected. The water runs from the wheel, along a case surrounding its lower half, into a reservoir *u*, from which the lower cylinders *x x* are alternately supplied.

In order to produce the vacuum, the necessary quantity of gas is supplied to the cylinders by means of the pipe *k k k*, to be conveniently attached to a gasometer. The gas also passes along the small pipe *l l*, (communicating likewise with the gasometer), and being lighted at both ends of that pipe, is constantly burning for the purpose of igniting the gas within the cylinders.

The water in the reservoir *v*, passing down one of the pipes *w* into one of the lower cylinders *x*, causes the float *y*, in that cylinder, to rise, and pushing up the rod *o*, raises the end *b* of the beam, which of course draws up with it the cap *f*, and forces down the cap *e* of the other cylinder *c*.

The gas being admitted along the pipe *k*, the flame from the pipe *l* is now freely communicated to the gas in the cylinder through the orifice, by the opening of the sliding valve *s*, which is raised by the arm *r*, lifted by the rod *o*, by means of the beam.

To produce the intermitting action of each cylinder, some subordinate machinery is put in operation, by chains and rods attached to a glass or iron vessel *p*, partly filled with mercury, and, turning upon a pivot, each end receives its movements of elevation and depression from the rise and fall of the projecting arms *q*, by the action of the beam above; the mercury being furnished for the purpose of regulating the supply of the gas into the cylinders, and the movement of the slide in the trough *p*. By the action thus communicated, the water from the reservoir flows down the pipe *w* into the vessel *x*, and produces the elevation of the float *y* and the rod *n*, and raises the cap *e* by the ascent of the beam at *a*.



The motion thus caused in this part of the machinery, operating upon its duplicate parts on the other side, of course produces by its

action, a corresponding movement; and the slider in the trough *v*, moved by the action of the mercurial tube *p*, being removed from its position, allows the water to fall into the other pipe *w*, and as it ascends, suffers the float *y* to descend, and rising into the main cylinder, thus lifts again the beam at *b*, and its connexions, and forces down the cap *e* on the top of the other cylinder.

After the vacuum is effected in the cylinders, the air must be admitted, to allow the water to be discharged, and the caps to be raised: this is accomplished by means of a sliding valve in the air pipe *m m*, acted upon by chains *t t*, attached to the floats in the reservoir, and as motion is given to them, the valve is made to slide backwards and forwards, so as to allow of the free admission of atmospheric air.

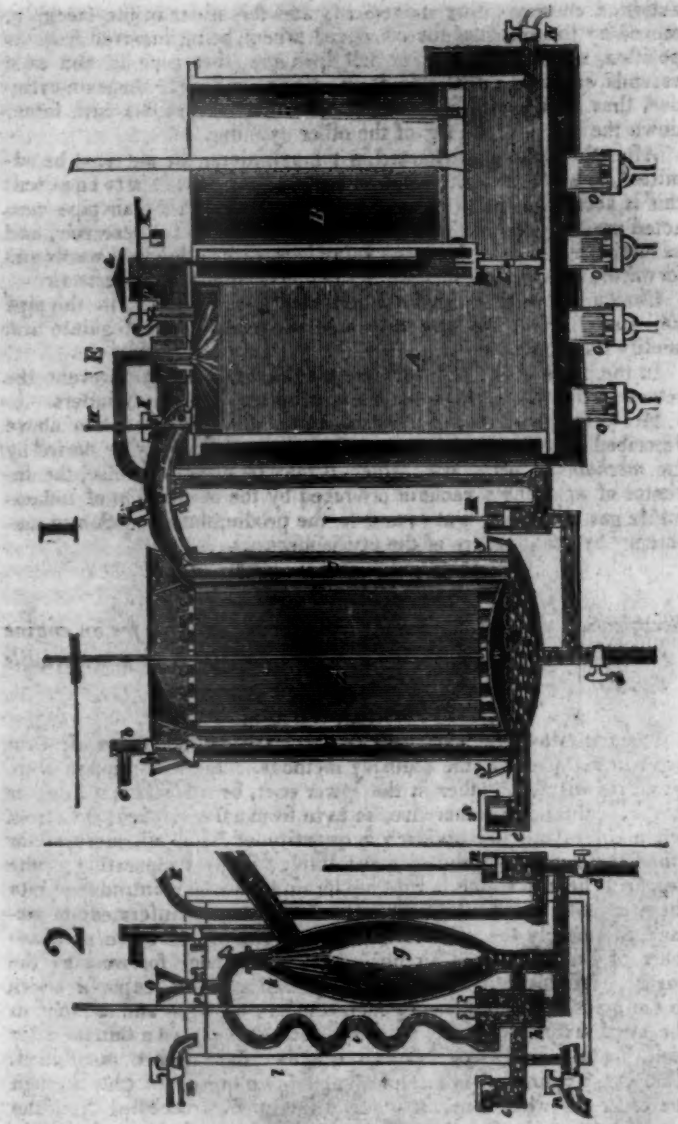
Chains *u u*, with suspended weights, open the cocks in the pipe *k k*, and produce the alternate flow of the gas, and regulate and modify its supply.

In the pipes *g i g* and *h j h* are clacks, or valves, to prevent the return of the water, when the air is admitted into the cylinders.

Mr. Brown claims to be the inventor of the combination above described for effecting a vacuum, *however much* it may be *varied* by the *mechanical means* with which it may be used; and also, the inventor of applying a vacuum produced by the *combustion* of inflammable gas, to raising water, and to the production of motion in machinery by the pressure of the atmosphere.

Specification of a patent granted to Thomas Howard, for an engine to be set in motion by the vapour of alcohol, ether, or other volatile liquids.

I ERECT two metal cylinders (A B, drawing No. 1,) made firm and secure by any of the ordinary methods. These cylinders communicate with each other at the lower part, by a horizontal tube, or smaller cylinder, or otherwise, so as to form a free passage at C, from one to the other. Then such a quantity of fixed oil, mercury, or other fluid, or substance becoming fluid, but not evaporating at the degree of heat to which it will be there exposed, is introduced into these cylinders, as will fill the base of the one, the intermediate passage, and nearly the whole of the other cylinder, to serve as a medium of heat necessary for generating the vapour for working the engine. Within one cylinder B, is placed a piston, exposed above to the pressure of the atmosphere, and having a rod and stuffing, in the usual manner. In the other cylinder A, is placed a thin metallic dish, floating freely upon the oil, or other fluid before mentioned. This latter cylinder has a top fastened down quite air-tight, through the centre of which top, is brought a tube E, proceeding from the condenser (hereinafter described,) the lower end of which tube within the cylinder, terminates in a nosle pierced with many small holes. This tube is passed through a piece of cork, wood, or other imperfect conductor of heat, fixed into the top of the cylinder with a ring



screwed down above it, in which the tube is made secure by a small screw F, in order that all these parts may be air-tight. In the top of the cylinder A, is an oblong orifice, closed by a valve G, of the like

form, which opens inwards by a rod H, striking the valve near one end with the advantage of a lever (as a door,) at which end is a small hollow, for the purpose of receiving the rod; at the other end, the valve is confined to its seat by a crane-neck spring, bending over, above it (as in the drawing No. 1, near G:) the rod is entirely detached from the valve, so that the rod has the power only to open the valve; the advantage of which is, that any accidental irregularity in the motion of the rod, will not derange the valve itself. The valve-rod passes through an air-tight stuffing box I, in the usual manner. A safety valve K is placed on the top of the cylinder A. There is an orifice through the piston, into which is fitted a plug, or stopper, by means of which the height of the oil, or other fluid, hereinbefore described, above the piston (which should always be kept a little above the piston,) may be regulated when necessary. The oil, or other fluid, may at any time when required, be withdrawn from the cylinders by a cock, N, near the bottom, and may be again introduced by the top of the piston cylinder through the orifice in the piston. The degree of heat necessary for the purpose of working my Vapour Engine, is obtained by means of a sufficient number of lamps, *o*, *o*, *o*, *o*, on the principle of the Argand lamp, and on a large scale, when required. These lamps are supplied with oil, or other inflammable liquid, or gas, and placed below the cylinders, and the chimnies of which lamps are passed into, and through, a thin metallic or other covering, which covering is carried round both the cylinders (except the upper part of the piston cylinder,) at a small distance from the cylinders, so as to confine and carry the heated air entirely round them. The lamp chimnies should be made of metal, with a hole therein, covered with talc, through which the flame may be seen, for the purpose of regulation. There is a tube or chimney, P, at the top of the last mentioned covering, which tube may be more or less closed by a top or register, Q, the better to regulate the heat of the air within the covering. By means of a small forcing pump, R, which is set in motion, and the length of its stroke regulated by any of the ordinary methods in use, in the steam engine, the tube E, which enters the top of the vapour cylinder, is supplied from the condenser with the liquid, which is afterwards to be converted into vapour, within the cylinder A. The liquid to be employed may be either alcohol, ether, essential oil, or other liquid which evaporates more rapidly, and at a lower temperature than water. I do not, however, confine myself to any particular liquid or liquids, for even water may be used if the heat be sufficiently raised. The degree of heat to which it is proper to raise the oil, or other fluid medium within the cylinders, must be varied according to the nature of the liquid to be evaporated, and to the extent of power required. In order readily to ascertain, and be enabled to regulate correctly the degree of heat within the cylinder, a thermometer is attached to any convenient part, with its bulb passed through the cylinder into the oil or other fluid medium. From the nosle of the tube E, above described, a sufficient quantity of the liquid before mentioned is thrown by the action of the forcing pump, R, not gradually, but quickly,

and at once, upon the dish, which being previously heated by the oil (or other fluid medium,) on which it floats, quickly converts the liquid thrown on it into vapour, which vapour receives an increase of expansive power by the heat of the cylinder, and pressing upon the oil (or other fluid medium,) and dish floating thereon, forces the oil through the horizontal passage C, into the piston cylinder, and raises the piston to its highest point of elevation. The valve G in the vapour cylinder being now opened, the vapour escapes by a tube S, into a separate vessel Z, (as in the steam engine of Watt,) and is there condensed; the piston then returns by the pressure of the atmosphere, and the dish is carried again to the top of the vapour cylinder. The valve G is now closed, and a fresh portion of liquid is thrown by the forcing pump upon the dish, to be converted into vapour, and the operation is repeated as before. The dish is not absolutely necessary, as the liquid may be thrown upon the oil (or other fluid medium;) but I prefer a dish, which should be made of copper, with a flat bottom, the internal surface of which should not be polished. A sliding valve *o*, is placed across the horizontal tube, or passage, between the two cylinders, so as, occasionally, either entirely or partially, to close the passage from one cylinder to the other, by means of which the motion of the engine may be easily regulated or stopped. In the top of the cylinder A, is fixed a tube S, by which the vapour is conveyed from the cylinder to be condensed; and this tube should be divided, and a ring of cork, wood, or other imperfect conductor of heat *a*, should be placed between the two parts, which should then be screwed up together, air-tight. By means of this arrangement, the transmission of the heat from the cylinder to the condenser is interrupted. The other end of the tube is inserted into, or communicates with, a circular tube or hollow ring, V V, into which a number of smaller tubes, marked severally U, made of copper or other metal, as thin as the required strength will permit, are fixed and arranged in a circle. These smaller tubes are also inserted into another vessel below, W, which forms a reservoir for the vapour when condensed. The liquid formed by the condensed vapour may, by means of a pipe with a cock *d* placed in the bottom of the vessel, be withdrawn when required. The outer and upper part of the condenser has upon it a circular basin or open vessel X, into which water is thrown by a pump or otherwise, as may be convenient. The smaller tubes severally marked U, are each wrapped round and covered on their external surface with flannel, or other porous substance of the like nature, which is carried over into the upper ring or basin X, from whence, being previously wetted, the water is absorbed, and the flannel or other porous substance used, acting like a syphon, conducts it down the outside of these tubes into a vessel Y below them, from which it may be allowed to run off, or be pumped again into the upper vessel X, if required. Within the hollow circle formed by these smaller tubes, severally marked U, is a machine upon the principle of a fan, kept in rapid motion by the engine or otherwise. By this means a continued stream of air is thrown upon the wet flannel, or other porous substance, and the heat is conse-

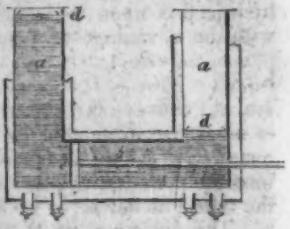
quently thereby more quickly withdrawn from the condenser. Previously to setting the engine to work, it is necessary to withdraw the air from the condenser and vapour cylinder, which is done by means of an exhausting pump or syringe applied at *c*, to a pipe with a stop-cock *b*, fixed on the top of the condenser. The liquid to be converted into vapour for working the engine, is introduced into the vessel or reservoir at the bottom of the condenser, through a tube *e*, closed by a screw cap *f*. From this vessel or reservoir (the fluid in the cylinder having been first heated,) the liquid is thrown into the cylinder A by the forcing pump R, as before described. A mercurial gauge may be fixed in the usual manner to any part of the condenser, in order to show the degree of exhaustion within. This method of producing condensation, consists in exposing the vapour or elastic fluid to be condensed, to a large surface of metal, surrounded or covered with flannel, or some other porous substance, continually absorbing water, and at the same time acted on by a stream of atmospheric air. And I claim the application of this new method of producing the condensation of the elastic fluids or vapour, as applicable generally, and not as applicable to my engine only. The condensation of the vapour or elastic fluid, may also be effected by injection upon the same principle as in the steam engine, but with the advantage of dispensing with the constant use of an air pump, and effectually preventing the escape of any of the vapour, or liquid. To effect the condensation by injection, a tube S, (drawing No. 2,) conveys the vapour into an oblong vessel *g*, made of copper or other metal, as thin as the pressure will allow. The required quantity of the liquid before mentioned, and to be afterwards thrown into the cylinder, is introduced into the condenser or vessel *g*, by the tube *e* as before, or by a funnel *o* on the top through a stop cock *p*. The forcing pump R, the tube E, to convey the liquid into the cylinder, the pipe and cock *b*, for withdrawing the air, and also the pipe and cock *d*, by which the liquid may at any time be withdrawn, are constructed as in the hereinbefore described condenser, and answer the like purposes. A lifting pump *h* is put in motion by the engine; at the same time the valve in the vapour cylinder (G, in the drawing No. 1,) is opened as hereinbefore described, and the lifting pump withdrawing a quantity of the liquid before mentioned from the bottom of the vessel or condenser *g*, injects it into the top of the same vessel after passing it through a pipe or worm, *i*, the end *k*, of which pipe being pierced with many small holes, the liquid is dispersed throughout the vessel *g*, and condensing the vapour therein, passes with it to the bottom of the vessel. Part of this liquid is again thrown into the cylinder by the forcing pump R, to be converted into vapour as before described, and part of it is again employed to condense the vapour in the manner last before mentioned. In effecting the condensation by injection, the condenser and tubes connected therewith are immersed in a cistern of cold water, a stream of which is continually passing through it, as in the steam engine. The vapour engine hereinbefore described, operates against the pressure of the atmosphere. This may be avoided, and a double

action produced by the following alterations: (the Specification then proceeds to describe them.)

Although I prefer the use of lamps upon Argand's principle, in order to obtain the requisite degree of heat, to give motion to my vapour engine; yet, an engine may be so constructed that fuel of any kind may be used. The foregoing are some of the combinations of machinery to which my invention is applicable, but I moreover claim, as my exclusive invention, the application for the purpose of giving motion to machinery, of vapour generated from liquids within the cylinder or other vessel, in which the power operates, the vapour receiving an increase of expansive power by the heat of the said vessel; particularly when the vapour is generated from such liquids as evaporate at a lower temperature than water.

THOS. HOWARD.

The annexed drawing describes an engine, which operates against the pressure of the atmosphere, and upon which also depends the return or vacuum stroke of the piston. Two methods of avoiding this and producing a double action, are given in the specification, but which are not inserted here. The following diagram presents an outline of a very effectual arrangement. *a a* are the vapour cylinders or vessels (the form of which may be varied;) *b* is the piston cylinder; *c* the piston, working horizontally. The arrangement of the lamps, injecting tubes, &c. is upon the same principle as before. The vapour is alternately generated within, and withdrawn from the two vessels, *a a*, and acts upon the piston through the medium of the oil or other fluid, upon which, or upon the thin copper floats, *d d*, the small quantity of liquid to be evaporated is injected, as before described.



*Remarks by the Patentee.**—I have denominated my invention a "Vapour Engine," because the vapour of certain liquids, other than water, may be advantageously employed, the term steam being more properly applied to an engine which is worked exclusively with the vapour of water.

When the idea first occurred to me of employing, instead of water, liquids which evaporate at a lower temperature, I perceived, immediately, that it would be hopeless to attempt the practice of such a theory upon the present principle of the steam engine; and when I afterwards found that such had actually been attempted with alcohol, I was not surprised that it had proved abortive. To say nothing of the danger of placing a furnace under a boiler containing a large quantity of an inflammable liquid, it would be almost impossible to

* Of these remarks we have abstracted a small part only, and that, not so much with the design of showing the views of the patentee, as of exhibiting the principle upon which the anticipated advantages of vapour engines generally is founded. EDITOR.

prevent its escape, which would soon amount to far more than the saving of fuel that would be made upon *that plan*. After making many experiments, it appeared to me that the vapour might, by a new and proper arrangement, be generated within the cylinder itself, and thus do away with the necessity of a separate boiler or generator of any kind. I ascertained that ether or alcohol would evaporate with sufficient rapidity, and would produce an instantaneous and very great pressure in a closed vessel, if the surface upon which a small quantity was thrown were heated to about 100° above the boiling point of the liquid. In these experiments mercury was employed as a medium upon which to evaporate the liquid. The following table will explain the system.

Ether at the Temperature	Alcohol at the Temperature	Water at the Temperature	Force of Vapour in Atmospheres	Cubic Inches of Vapour of Atmospheric Pressure produced from 1 cub. inch of Liquid	
100°	175°	212°	1	1800	
140	215	252	2	3600	Pressure in Vacuo at the Temperature 60° in inches of Mercury. Ether 12 in. Alcohol 2 in. Water ¼ in.
180	255	292	4	7200	
220	295	332	8	14400	
260	335	372	16	28800	
300	375	412	32	57600*	

and so on in proportion, for every additional 40° of heat, but gradually decreasing in effect as the temperature advances. The calculations are given only as an approximation sufficiently correct to illustrate the theory.

Suppose it be required to work an engine with ether, having a cylinder or vapour vessel or vessels, 20 inches in diameter and 30 inches in length, and with a pressure upon the piston, or (which is the same in effect) upon the intermediate fluid, of eight atmospheres, and which would be a very powerful engine. Such a vessel as that above described will contain about 10,000 cubic inches. This will require the evaporation of about 5½, say 6, cubic inches of ether at 220°, and as 6 cubic inches contain nearly 1600 grains or drops of liquid, 5 drops must be evaporated from each square inch, since the diameter of the vessel, 20 inches, presents a surface of about 320 square inches. Five drops of ether upon a square inch of surface heated to 220°, will evaporate with a rapidity sufficient to produce a motion equal at least to the condensing steam engine. By decreasing the heat or the quantity of liquid injected, the effect will be decreased in proportion, so that the motion and power of the engine may be governed with great exactness. If the quantity of liquid

* In a subsequent communication, the patentee states that this fifth column is incorrect; the scientific reader will make the same remark upon the fourth, in which, the force of vapour is made to double with every addition of 40° of heat; this is only an approximation. EDITOR.

injected be decreased, and not the heat, the power (pressure) only will be decreased: the motion, so far as depends upon the quickness of evaporation, may even be increased. The relative proportion between the motion and power, also, depends upon that between the surface of the piston and the surface of the intermediate fluid, which receives the pressure of the vapour. It is not necessary at present to enter fully into this part of the subject; there must be, of course, a certain modification with regard to the temperature and the quantity of liquid injected, which must be found, by practice, to produce the most advantageous result; this will vary according to the purpose for which the engine is designed, and from other circumstances.

Alcohol will furnish the same results as ether, if the temperature be raised 75° higher; and upon the whole, this liquid may perhaps be preferable, particularly as it may be more readily and effectually condensed.

Water will also give the same expansive power at 112° higher than ether, or 37° higher than alcohol; but the motion of the engine would be comparatively slow at this degree of heat, and, therefore, independently of the necessary increase of temperature, the greater quantity of latent caloric absorbed by its vapour, and other circumstances, the same effect can only be produced from this liquid by a greater consumption of fuel.

It is scarcely necessary for me to point out to those who are conversant with these subjects, the advantages which will result from the employment of the vapour engine, particularly in navigation. It is proper, however, that I should take some notice of them. The most apparent are,—the very small consumption of fuel; the absence of all nuisance from smoke, and of a chimney flue, when lamps are made use of; the trifling space occupied by the quantity of oil, or other material, necessary, even for the *longest* voyage, compared with that at present required in steam vessels for the stowage of coal; the small space occupied by an engine of the greatest power; its perfect safety, portability, and moderate expense of construction.

Account of a patent granted to ARNOLD BUFFUM, *late of Massachusetts, but now residing in the City of London, (being one of the people called Quakers,) Hat Manufacturer, in consequence of communications made to him by certain foreigners residing abroad, and discoveries made by himself, for an Invention of certain Improvements in the process of Making, or Manufacturing, and Dying Hats.*

THE patentee states, that there are four principal objects accomplished by this invention; 1st, facilities in the process of dying hats; 2nd, the production of a more perfect colour; 3d, the prevention of any of the damages to which hats are subject in the common mode of dying; 4th, the accomplishment of the dying process in a much shorter time than by the usual methods, and of consequence lessen-

ing the deleterious effects of the dying materials upon the hat itself, which frequently does great injury.

It is considered by the patentee, that the process of dying hats will be greatly facilitated, and the colour improved, by occasionally removing the hats from the dye vat or copper, and exposing them to the oxygen of the atmosphere; and it is also observed, that the colour of the hats suffers injury by touching the sides of the vat or copper in dying, and in being pressed against each other. In order, therefore, to remove the hats occasionally from the dye copper with convenience and facility, and at the same time prevent their being brought in contact while immersed in the dying liquor, an apparatus is proposed by which these objects may both be effected.

One method of constructing the apparatus is to make a vat, or dye-kettle in the form of a half cylinder, with flat ends; within this, a hollow frame work wheel is made to revolve, like a grindstone in its trough; one half of this wheel, when placed upon the kettle, will be immersed in the dying liquor, and the other half exposed to the air. Within the rim of this wide wheel there are pegs upon which the hats to be dyed are placed, so that as it revolves they are successively passed into, and out of the dying liquor.

This wheel may either be kept revolving with a very slow motion, by gear connecting its axle to any moving power, or it may be turned half round at intervals of about ten minutes apart; by which means, the hats hung upon the pegs will be alternately immersed for the space of ten minutes in the dying liquor, and then for the same space exposed to the atmospheric air.

In this way it is considered that the process of dying hats may be greatly facilitated and improved, as the occasional transition from the dye vat into the air, and from the air again into the dye, will enable the oxygen of the atmosphere to strike the dye more perfectly and expeditiously into the materials of which the hat is composed, than by a continued immersion in the dye for a much greater length of time.

A variation in the mode of performing this process, is suggested, and the apparatus proposed to be employed, is a square vat or vessel to contain the dying liquor; and a frame or rack having a number of pegs placed in it for hanging the hats upon, which are about to be dyed, in a similar manner to the wheel above described. This frame or rack is suspended by cords from a crane, and may in that way be lowered down with the hats into the vat, or drawn up and exposed to the atmosphere; which changes are recommended to be made every ten minutes until the dying is completed.

[*Newton's Journal.*

Account of a patent granted to JOHN ROTHWELL, *Tape Manufacturer, for his Invention of an Improved Heald or Harness for Weaving.*

THE object of the patentee, in the construction of these improved healds, or harness for guiding the warp threads in a loom, appears

to be to afford greater space for the passage of the warp threads, as the sheeds open, or pass each other, than is afforded in the ordinary kind of healds employed for the weaving of fine fabrics.

It is proposed to make the loops of the healds double, that is, passing over the shafts at top and bottom, and meeting both at the back and front; and also that the headles shall be formed by long and short loops alternately; that is, one of the upper loops being long, and the lower loop connected to it, short, the next upper loop is to be short, and its lower loop long, and so on alternately. By these means, the knots of the one series of loops, will be a little distance above the knots of the other series of loops, and the warp threads passed between these knots will be depressed as the heald descends, by the upper series of knots, and raised as the heald ascends by the lower series of knots for the passage of the shuttle between them; the threads being thereby enabled to pass each other with greater freedom, and of consequence less friction, the space for the warp being open in the middle.

Healds are usually made of woollen or hempen cord, twisted very hard, and called heald or headle yard; these improved healds may be made of the same material, or they may be fine wires, which in some cases would perhaps be preferable. [*Ib.*

Account of a patent granted to JOHN FREDERICK SMITH, *of Dunstan Hill, Chesterfield, in the County of Derby, Esq. for his Invention of Improvements in the process of Drawing, Roving, Spinning, and Doubling Wool, Cotton, and other fibrous substances.*

THE patentee has discovered that it is very desirable, in the processes of roving, spinning, and doubling of wool, cotton, and other fibrous substances, to prevent, as much as possible, the fibres of the material being disturbed, or drawn out of the positions in which they were first placed by the carding engine; and in consequence of this discovery, it is directed that in all the future operations to which the fibrous materials may be subjected, whether of roving, spinning, or doubling, that the fibres should be carried through the several engines in the same direction, that is, always beginning with the end which was first delivered, or wound in the preceding machine; and this is the invention of improvements in the processes of roving, &c. which constitutes the subject of this patent.

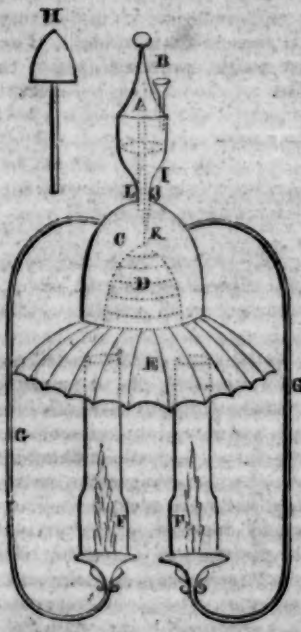
The instructions of the patentee, in carrying this invention into effect are, that the operator should observe carefully which end of the sliver first came from the carding engine, and of consequence to introduce that end first into the roving machine, and continue to observe the same direction of the fibres in all the subsequent stages of operations, that is, spinning, &c. And here it is to be observed, that if the rovings are conducted into cans, which is sometimes the case, that then, cans with their two ends open are to be used, because by

the employment of these cans, the ends of the rovings which were first delivered, may be readily got at. And when the rovings are to be wound upon bobbins, it is desirable to employ the new invented bobbins with moveable ends, for the capability which those bobbins possess of enabling the cop to be slidden off its barrel, will likewise afford the means of getting at the interior of the cop, for the purpose of finding the end of the roving first wound upon the bobbin, that the spinning may commence from that end.

This mode of proceeding, the patentee considers, cannot fail of producing a much more smooth and even yarn, or thread, than could be effected by the ordinary mode of roving and spinning. [*Ib.*

Self-generating Gas Lamp.

(From the Edinburgh Philosophical Journal.)



The oil vessel of this lamp is represented at A. B is the tube by which the oil is admitted; C is the generator; D is a hollow vessel, where the heat from the burners F, underneath, is collected; the dotted lines are projecting ridges on it, within the generator, to prevent the oil running down and collecting at the bottom of the generator. E is a circular piece of iron, to collect and retain the heat. G are tubes to conduct the gas from C to F. L is a tube to supply the vacancy in A with gas, as the oil is discharged into C. H is a metal heater to fit into D.

To use the lamp, fill A partially with oil, alcohol, or any fluid from which gas is produced, and having made the metal-heater H red-hot, place it in the bulb D; after it has continued in it a minute or two, turn the stop-cock I, allowing the fluid to drop slowly on the heated bulb D, below, by which it will be converted into gas. When it is found to escape in sufficient quantities from the burners at F, set it on fire, remove the heater, and a beautiful bright flame will be supported by its own heat as long as there is oil in A.

It may be found necessary to replace the first heater by a second, when the lamp is used for the first time, to expel more effectually the atmospheric air from the generator and tubes. The heat collected in D will be found sufficient to generate gas to a third burner,

if required, as it is an indisputable fact, that most bodies, in a state of combustion, give out much more heat than is requisite to support an equal body of flame, and this is quite evident, by fire spreading so rapidly in all combustible substances, if not checked.

ON GILDING.

Gilding upon Bronze. *Continued from p. 392, vol. 4.*

7th. *On giving the colour of Or Moulu.*—When it is desired to give to gilt articles the colour of *or moulu*, the scratch brush is used less freely than usual; the work is then *restored*, by heating it more highly than when it is to be left *mat*, and it is afterwards allowed to cool a little. The *or moulu* colouring, is a mixture of blood stone, alum, and common salt; these are diluted with vinegar, and applied with a pencil, over the surface of the gilding, taking care to avoid the parts to be burnished: the piece is then placed upon lighted charcoal, which may be rendered more active by gently blowing it; the heating is continued until the work begins to assume a black colour. The piece should be sufficiently hot to cause water sprinkled upon it to be rapidly converted into vapour. The article is then withdrawn from the fire, and plunged into cold water; it is to be well washed, and the orange colour which the gilding presents, is equalized by rubbing the piece with a pencil dipped in vinegar, if the surface be smooth, or with weak nitric acid, if it has been ornamented with the graver, or the chisel. In either case, the article is to be well washed, and dried at a moderate fire.

8th. *On producing the colour of red gold.*—When the gilding is to receive the colour which distinguishes the triple alloy of gold, silver, and copper, usually employed in the manufacture of jewellery, this is effected by the subjoined operation.

The work, when sufficiently gilt, is, whilst warm from the fire, to have a fine iron wire attached to it, and is immersed in, or covered with, the composition known under the name of *gilding wax*; this is made of yellow wax, red ochre, verdigris and alum: when thus prepared, it is heated strongly over a charcoal fire, and the inflammation of this covering of wax is promoted, by throwing some small pieces of the same substance into the fire: the work must be turned about on the fire so as to heat, and burn off the wax on every part at the same time; when the whole of the gilding wax is burned off, and the flaming has ceased, the piece is to be plunged into water and well washed and scratch brushed; using pure vinegar in the operation. If the colour is not good, and the tint equal throughout, the piece should be covered with a solution of verdigris in vinegar, dried on a gentle fire, again washed in water, and scratch brushed with vinegar; should the colour be too dark, a little weak nitric acid, may be used, instead of the vinegar. After being coloured, the work is to be washed, burnished, again washed, wiped with soft linen, and dried by a gentle heat.

In performing the foregoing process, the utmost care is necessary

to avoid the deleterious effects of the mercurial, and other fumes. Great numbers have fallen early victims to this business, or after a few years devoted to it, have been rendered impotent for the remainder of their lives. To obviate these fatal effects, M. D'Arcet has devised such arrangements in the forges and furnaces used in the large manufactories, as cause them completely to carry off the vapours, without exposing the workmen to their action. In the *Dictionnaire Technologique*, there are drawings of the plan and elevation of such an establishment, where the business is to be carried on very extensively; these we have not thought it necessary to give, as, with us, gilding is only an occasional business. It is of high importance, however, to avoid the mercurial vapour, even in a single operation, especially when large pieces are to be gilt. For this purpose the forge chimney should have a strong draft, the air for which may be supplied by tubes leading to the outside of the building, which may be regulated at pleasure, whilst that from doors and windows is irregular, and if admitted in sufficient quantity, would frequently render the workshops uncomfortable.

M. D'Arcet advises the gilders not to touch the mercury with the naked hands, when it can be avoided; and to wear gloves of leather, or of bladder, or, which is best, of waxed silk. Before leaving the workshop, and especially before eating, the hands and the mouth should be carefully washed with warm water, and afterwards with soap and water, to completely remove the amalgam, and the nitric solution.

GILDING ON IRON AND POLISHED STEEL.

Guyton de Morveau has pointed out a very easy manner of gilding, durably, upon iron and steel, after they have been polished. The following is his process. Gold, rolled very thin, is dissolved to saturation in nitro-muriatic acid *(aqua regia;)* upon this is poured a quantity of ether, equal in volume to the quantity of acid employed. The whole should be placed in a flask of double the capacity of the two liquids; it is to be well stopped and strongly shaken, when the ether will take up the gold, which the acid had dissolved, and will be found swimming upon it, exhibiting a beautiful yellow colour. This liquid is to be separated from the acid by means of a funnel with a very small opening; the acid being the heaviest may be allowed to flow out first, and at the instant the ether begins to follow it, the receiving vessel must be changed. The liquid must be carefully stopped, and preserved for use.

When any piece of iron or steel is to be gilt, it must be first well polished, and slightly warmed, the auriferous ether may then be applied with a pencil, the ether will quickly evaporate, and leave the gold, which may be firmly fixed with a burnisher.

GILDING BY HEAT, WITH LEAF GOLD.

The metal intended to be gilt, whether iron, copper, or brass, is first made smooth with a scraper, and burnished. It is then placed on the fire, and heated, until, if it be iron, or steel, it acquires a blue colour; and to an equal degree, if it be copper or brass; a piece of

gold leaf is then applied on the part to be gilt, and gently rubbed down with the burnisher; the work is again placed upon a moderate fire, to restore it to the former temperature. Several coats of leaf may be thus applied, successively; each coat is formed of a single leaf for ordinary work, and of two leaves for finer articles. The work is placed on the fire, and the gold burnished on for each coat, and the burnishing is continued on the last, until the metal is cold.

COLD GILDING ON METAL.

Dissolve about 60 grains of fine gold, rolled very thin, and ten or twelve of pure copper, in two ounces of nitro-muriatic acid (*aqua regia.*) When the solution is complete, it is to be poured, drop by drop, upon clean linen rags, sufficient in bulk to absorb the whole of the liquid; these are to be dried, and then placed upon a china plate, and reduced to cinders, taking care in lighting them not to use a sulphur match. These cinders, of course, contain the gold in fine powder.

When a piece of metal is to be gilt with this powder, it must be prepared by being left with a clean surface, such as is given by a fine stone, or charcoal; a small pad of linen is to be slightly moistened, and dipped into the box containing the powder; with this the work is to be rubbed, until its surface is sufficiently covered with gold. Large articles are afterwards burnished with blood stone burnishers, and smaller ones with those of steel, using soap suds, to prevent scratching, or stripping the gold.

GILDING THE EDGES OF BOOKS.

Equal parts of Armenian bole, and of sugar candy, are to be well rubbed together in a dry state; a portion of well beaten white of egg is then added, and the whole carefully incorporated. The book to be gilt is placed in the cutting press, its edges smoothly cut, and polished; a light coat of white of egg is then passed over it, and allowed to dry, after which the same is to be done with the composition above described; when this latter is perfectly dry, it is to be rubbed smooth and polished; it is then ready to receive the gold. To apply this, the prepared edges of the leaves are to be moistened by means of a hair pencil, dipped in clean water, and the gold immediately laid on. The burnishing is effected by rubbing the gold, when dry, with a dog's tooth, or agate burnisher.

GILDING ON THE COVERS OF BOOKS.

When the binding of books is completed, a portion of well beaten white of egg is passed over those parts which are to be gilt, in a similar way to that described in the preceding article; this operation, however, may be dispensed with: the gold is then laid on, and fixed in its place by what are called *binders' tools*, which are made of brass, and have the intended ornaments engraved upon them, in relief. These tools are to be heated and pressed upon the leaf, and wherever they have touched, the gold will adhere firmly. The superfluous gold is then rubbed off with a piece of cotton wool, which is to be preserved, and burnt, to obtain the gold from it.

Observations on the use of Seneca Oil, and particularly on its employment for the purpose of producing illuminating gas, in the city of Pittsburgh.

[Extracted from a letter to the Editors of the Pittsburgh Gazette.]

* * * "I SEE that the corporation has, at last, determined to light the city: it is a very sensible determination, for indeed few places needed it more. I fear that lighting with gas will be found troublesome and expensive, in spite of the vast supply and cheapness of the coal. But I will tell you what is the cheapest, best, and most economical light you can use: it is what is called, in the west, Seneca oil; which is Petroleum, with some peculiar characteristics which distinguish it from that which is found in various other parts of the world, in the Cornish and Devonshire mines, in England, for example.

"It would be superfluous in me to describe this oil to you; to tell you how it is found throughout all the coal formation west of the mountains, in springs; in the rivulets which flow out of coal mines; in certain clays or earths, from which it is separated, as it was formerly, to considerable amount, on Oil Creek, by manipulating it in water; and also floating on all, or nearly all, the salt wells. This substance, were there a ready market for it, might be supplied at your very doors, to an almost unlimited extent. At present it is almost valueless, being used only as an ingredient in what is called "British Oil," and as a horse medicine, (in which, by the bye, it is very useful.) The price of it is very low, because a few barrels glut the demand of the apothecaries; but if the city would take a large quantity, or if it were brought into general use otherwise, I believe it could be supplied at 25 cents per gallon. This may be said to be a very indifferent price for the article, unless it existed in great quantities in particular places—that it would not be worth the trouble of collecting; and of course, being neglected, the price would rise for want of a supply, and then such quantities would be brought forward as to injure the dealers, a thing always to be deprecated in a well regulated country. Few things, however, offer so direct a proof of the doctrine, in political economy, that *value* is the effect of labour—a doctrine which I do not confess to be true in every instance, nevertheless. The substance in question is diffused throughout the country, and this will make it abundant in the market; but wherever it is found, it rises and accumulates slowly, and what is accumulated can be collected in a few minutes, with scarcely any labour, except where it is procured from the peculiar clay banks in which it is found. The salt wells may be cleared of what floats, by letting a blanket down every quarter of an hour, and this will also apply to the springs where it is discovered. It is like honey and beeswax, of which few families have large quantities, but so many persons produce them that there is always a good and cheap supply in the market. Such articles, when extensively used in a city, and obtained from the surrounding country, beget an intercourse which is mutually beneficial. It is

manifestly desirable for a city to awaken to its interest by encouraging such a new object of trade, which, whilst it increases the circulation of money, will enable the country people to purchase more largely from the stores in town. In a word, it is the true policy of a city to enrich the surrounding country; and that city flourishes most, whose vicinage is the most prosperous.

"I need not argue further, to show the advantage of using Seneca Oil to light Pittsburgh, if it is applicable to the purpose. The proof of its applicability is only to be procured in the old and sure way—TRY IT. Let any one who doubts that it is a perfectly good oil for lamps, send to the apothecary's for half a pint, and burn it one night, in a lamp of any kind, precisely as fish or spermaceti oils are burned, observing only that to avoid smoke, it is necessary the length of the wick should be diminished. I have tried it, and found it succeed perfectly; but I have not tried it clarified; and there is no reason why it should not be clarified as well as any other oil, (and then it will burn as free from smoke,) by filtering or precipitating the gross particles contained in what is now brought to market. I am not chemist enough to give a disquisition on its component parts, but combustion shows that it contains more inflammable matter than animal oils.*

"Fish oil, to a considerable amount, is now taken over the mountains, for which you have to pay money, or money's worth: but if this oil gets into general use, I should not be surprised, if in a few years, it becomes an object of very large transportation to the east; thus affording a new article, to bring money to you. I proposed last winter, to one of the directors of the light-houses, to try this oil for those establishments; but, as yet, there is not a sufficient quantity on the sea-board, to authorize a large experiment of the sort. I believe it applicable to most of the arts in which oil is used, and have now employed a capable person to begin some experiments on it. Some of these applications are of my own invention, and if they answer my expectations, I think I shall patent them, which will be a slight recompense for introducing a new means of wealth to an extensive region. If no other good is produced by this communication, I hope it will have the effect of attracting attention, and causing experiments on a substance so abundant, which now runs to utter waste.

"Let me add another idea, which, I am conscious, will at first view be thought very visionary; but I say, *only try it;* the experiment will cost nothing. Many of the salt wells are filled, from the surface of the water to the mouth of the well, with inflammable gas: let a tight barrel with the head out, be let down, perpendicularly, into such a well, and after having remained some minutes, as the gas is heavier than the atmosphere, it will displace the latter, and fill the barrel: then let a wet blanket down, to cover the head of the barrel, and after it is drawn up, uncover a small space and tilt the barrel; then let a lighted candle, at the end of a long pole, be placed at the aperture: if the barrel be full of gas it will take fire, and probably explode. If this experiment succeed, the induction is clear. Bar-

* It has been recently discovered by Mr. Keller, governor of the mines of Trockawitz, in Galicia, that naphtha gives a light which compared with that from tallow, is as 1000: 935.—See *Repertory of Arts and Sciences.*

rels of gas, for the use of the city, if you choose to light with gas, will become as constant an article of commerce from the salt works as salt is now. These barrels may be emptied into a grand air-tight receptacle, easily contrived, and thence distributed, exactly as gas made from coal.—Here, then, is another source of income to the country. Indeed, Providence has been so bountiful to the whole west, that wealth seems to court you on every hand. Should the experiment of filling barrels with gas at the salt works, not answer, it will be very desirable that the city should cause an essay to be made on the production of gas from the Seneca Oil, which abounds with the materials for its production. It is well known that the use of animal oil to produce gas, has been extensive in England, after its superiority over gas from coal had been tested; but the high price of those oils there will probably prevent the general adoption of them for this purpose. Some writers, however, contend that they will produce gas at a cheaper rate than coal, in spite of the cost of them. If Seneca oil will supply more gas than animal oils, which I do not doubt; and if it can be procured at 25 cents per gallon, a fair trial of it in this way, would, assuredly, be demanded by common prudence.

"It seems to me, that indispensable as lighting the city is to the comfort and safety of the inhabitants, the corporation ought to deliberate maturely on the plan it will adopt, because any future alteration will be expensive, and because the lighting of a town is among the heaviest of its charges.

"You will excuse my troubling you so much at length, as it is only a fresh proof of the interest I constantly feel in every thing which concerns a city and a country where I have been kindly treated, and of my desire to repay that kindness with my feeble exertions. Were I to do them tenfold the good I ever expect will be in my power, I should still think myself in arrear." * * * MUCIUS SCÆVOLA.

Remarks by the Editor.—We have inserted the foregoing observations, because we apprehend that a portion of the information which they contain will be new to most of our readers, as it was to us; we refer particularly to the large quantity of Petroleum which can be obtained in the vicinity of Pittsburgh. That this material will afford an illuminating gas, by destructive distillation, is undoubtedly true; but we apprehend that it will not be superior to that obtained from the bituminous coal in its vicinity, and are convinced that it would be inferior to the gas from oil. In a manufacturing town, like Pittsburgh, the coke from a coal gas establishment, will be a very valuable article, and will, of course, greatly diminish the expense of carrying on the works. In Baltimore, where the gas is made from coal, the gas company have been unable to sell their coke, excepting on very disadvantageous terms; and we have but little doubt, that were it in their power to change the system, without serious loss, they would there adopt the use of oil, which possesses several advantages over coal; among these, are, the trifling residuum left from the distillation; the diminution in the size of the retorts, gasometers, and pipes, which, from the great illuminating power of oil gas, may be of

less than one-half the dimensions of those required when coal is employed; the avoiding the necessity of using lime to purify the gas, a process both troublesome and expensive; the comparative freedom of oil gas, from that offensive smell which predominates in coal gas, from the presence of sulphuretted hydrogen, which is but partially separated, by the purifying process, in the way it is actually conducted.

Those persons who have visited London, or Baltimore, and who have had an opportunity of comparing the odour emitted by the coal gas in those places, with that from the oil gas in New York, must be sensible of the very great difference between the two. At coal gas works, they tell you that this is accidental, but this information affords little consolation, as it is the accident of every day. We perceive that we are unwittingly travelling from Pittsburgh, to which we at first intended to have confined our remarks, leaving their application to other cities, to the understanding of the reader; we have taken a glance at London, Baltimore, and New York; and although we have not mentioned, we have thought of Philadelphia, and whilst we hope to see the brilliant gas light, illuminating our streets and stores, we also hope that they will never be polluted by the nuisance of coal gas. In Pittsburgh, where bituminous coal is generally used as fuel, the force of this objection is greatly diminished, and its cheapness will probably insure it a preference to all other substances. The high price of oil, in England, has not even there prevented the extensive use of it in gas works, and on our own sea-board, it can be afforded at a less price than that assigned to Seneca oil by the writer of the observations. It has been purchased in New York, by the gas company, at less than 25 cents per gallon, and, it is said, can generally be so purchased, in the large way.

The suggestions made respecting the obtaining of a combustible gas from the salt wells, which are generally filled with it, are, we believe, founded in an imperfect knowledge of the chemical constitution of the gases so produced; but as this is a subject with which the writer does not pretend to be intimate, the suggestion was perfectly natural; this gas affords an extremely feeble flame, and were it possible to transport it to the city, without incurring an expense manyfold greater than that of generating gas from coal, or from oil, it would scarcely make darkness visible. All the species of carburetted hydrogen, are lighter than atmospheric air, and if that contained in the wells is heavier, this must arise from its being contaminated with carbonic acid, (fixed air) which would still decrease its illuminating power.

On Speculums for Reflecting Telescopes. By the Editor.

The casting, grinding and polishing the speculums for reflecting telescopes, are mechanical operations of very great nicety, requiring a much larger portion of care and skill, than the grinding and polishing of glass lenses. There are but few manufacturers in England, whose reflecting telescopes are in much repute, although they are to

be found at most of the Philosophical Instrument makers; a telescope of this kind may appear at first to be good, but in a short space of time may afford a very indistinct view of such objects as are seen through it, in consequence of the tarnishing of the metallic reflectors. Different workmen have used different mixtures, although they almost uniformly consist, principally, of a mixture of tin and copper, to which other ingredients are added, and in the proportions of which variations are made. A good speculum must be perfectly compact, so that no pores can be discovered in it by the microscope; it must be sufficiently hard to take a fine polish, and to protect it from being readily scratched; it must not be liable to tarnish in the air, as this will effectually destroy its usefulness, and it must possess the property of reflecting nearly all the light which falls upon it. We have assisted in the operations of grinding and polishing, and intend hereafter to give such directions, as shall enable those who have patience, and skill, to perform them themselves. But few attempts of the kind have been made in this country, the demand for such telescopes having been but small. The first reflecting telescope made in the United States, was by the late Jotham Fenton, of New Haven, Connecticut; a man of much mechanical ingenuity, and of untiring patience. He followed the directions given in 'Imison's School of Arts,' and produced a good instrument;—this was about thirty years ago.

We published, in the last number, an article on the grinding and polishing of lenses, and design to give such further information thereon as will render the operation quite familiar. We now commence the republication of the observations on speculums, which originally appeared in the Nautical Almanac, for 1787, and which is still considered as one of the most useful essays upon this subject.

On Casting, Grinding, and Polishing Speculums, for Reflecting Telescopes, Microscopes, &c. By the Rev. JOHN EDWARDS, B. A.

On the best composition for Reflecting Specula.—I found that thirty-two ounces of copper, with fifteen or sixteen ounces of grain tin (according to the purity of the copper,) with the addition of a little brass and arsenic, viz.—one ounce of each to the above proportion of copper and tin, will form a metal, capable, when polished in a proper manner, of reflecting much more light than any other metal that has yet been offered to the public. When I say that the proportion of tin, is from fifteen or sixteen, to thirty-two ounces of copper, I would be understood that the proportion of tin will not always be accurately the same, as copper will take more or less tin to saturate it, according to its purity. It might be of use, previously, to purify the copper as much as possible. A very little experience in these matters will enable any one to know when the copper is completely saturated, as the composition will, if broken, appear of a most beautiful, bright and glossy nature, very much resembling the fine face of quicksilver. My method to ascertain that point accurately is to melt thirty-two ounces of copper, and to add to it, when sufficiently fused,

fifteen ounces of tin, and to pour the mixture into an ingot mould; then, to a certain known portion of this composition, I add a very small but known portion of tin; and thus, by a few trials, I can easily obtain the point of saturation, and the maximum of perfection. Having then ascertained what portion of tin I added to the above known quantity of the composition, I add the proportional quantity of tin to the whole, when melted a second time. Thus, if I find that I must add a quarter of an ounce of tin to one pound of the composition, so as to obtain the *ne plus ultra* of brilliancy,* then I know that when I shall melt the remainder of the metal a second time, in order to cast the speculum, I must add one of grain tin to four pounds of the composition, made according to the proportion of thirty-two ounces of copper, to fifteen ounces of tin. The arsenic must be added in the second melting, when the speculum is intended to be cast,† as the heat of the mixture in the first melting is so great as to render the most part of the arsenic volatile, and in a great measure prevent its action upon the metals. It is somewhat singular that arsenic, though particularly recommended by Sir Isaac Newton for this purpose, should be hastily thrown aside by the founders, as well as passed over unnoticed by the writers upon this subject. This imprudent disuse I can only attribute to the disagreeable fumes or vapours which arise when it is introduced into the crucible to the melted mixture, which may produce disagreeable effects upon the operator, if proper care is not taken to prevent them from being received into the lungs. All the precaution necessary is to bruise the arsenic coarsely, and introduce it into the crucible with a pair of tongs, having tied it up in a piece of paper; give it then a stir, with a wooden spatula, retaining your breath; avoid it till you can see no more vapours arise from the crucible, when the metal will be ready to be poured into the flasks, to cast the speculum. The great use of arsenic in this composition is to render the metal much more compact and solid, and indeed much more beautiful, as one may experience by comparing the composition with arsenic, with the same composition of copper and tin, without arsenic. In general, I find one ounce of arsenic sufficient for one pound of the metal. A much greater quantity of arsenic may be used without any disadvantage to the beauty or compactness of the metal, but then it is too apt to tarnish if exposed to the air for some time; three-quarters of an ounce, or an ounce of arsenic, to one pound of composition, will not tarnish in the least degree. Indeed, the reason why the metals generally made use of for specula, tarnish, when they are much ex-

* If too much tin should be added, viz.—if seventeen ounces of tin is put to thirty-two ounces of copper, the composition is not brilliant when broken, but of a gray blue and dull colour. If the quantity of tin be further increased, the metal will be almost black.

† Sir Isaac Newton melted the copper first, then added the arsenic, and lastly the tin; as, without doubt, he knew that the tin should remain in a fluid state the shortest time possible. It is true that he added the arsenic to the melted copper, but as he well knew that a great part of it would be rendered volatile, he therefore added a very large quantity of it, viz.—arsenic one, to copper six.

posed to the air, is because the quantity of copper in their composition is not nearly saturated, and the oxygen contained in the air, by acting upon it, extracts the copper from the tin, and turns the metal into a dirty or dingy-coloured speculum; and which (besides the loss of light) causes the common reflecting telescopes to show all objects of a dirty red, or yellowish colour. This, however, is not the case in the metals made of the above composition; for as the copper is completely saturated, the air cannot act upon it in the least degree. I must not, however, pass over one caution in the mode, or manner, of melting the composition, and that is, that the copper must be melted first of all, and rendered as fluid as possible; then the brass and silver (if any is employed) must be added, and the whole fluxed with the common black flux, made of two parts of tartar to one of nitre, or by stirring the melted mixture with a wooden spatula of birch, and made as fluid as possible. The tin must now be added, and the whole poured off immediately, after it is once stirred together; for if the mixture is continued on the fire some time after the tin is added to it, it will prove porous afterwards, though it be melted another time with the smallest heat possible. As I ever found this to be the case, I naturally conjectured that the metal would be most solid and free from pores when the tin remained the least time possible in a state of calcination. Experience determined the truth of my conjecture, and I now find that the best method possible to make this composition to the greatest advantage, is to melt the copper as fluid as possible, and flux it with the black flux; to melt the tin in a separate crucible by itself; to take the two crucibles out of the fire, and pour the melted tin into the copper; and stir it instantly with a wooden spatula, and pour the whole immediately into a large quantity of cold water. The sudden chill from the cold water divides the melted mass into an infinite number of small particles, and by that means cools it instantaneously, and consequently prevents the tin from calcining sensibly; and hence I have always found, that in the second melting the composition was entirely free from pores, even although no arsenic had been employed: yet the addition of arsenic ever rendered it more compact, and indeed specifically heavier,* as well as more brilliant and beautiful. On reversing the process, if the tin is put into the bottom of the crucible, and the copper at the top of it, which I have frequently done, the copper will melt with a very little heat; whereas, when copper is put into the crucible by itself, it requires a pretty strong heat to cause it to melt. When I first made use of this method, I imagined I had discovered a very easy one to melt the copper, and consequently I thought I had greatly improved the common method; and as Mr. Mudge ascribed the pores in the metal to the tin being calcined by the great heat of the fluid copper at its first melting, I naturally expected to find the metal, made by the above process, totally free from pores, especially in the second melting, as the heat was considerably less than if the copper had been melted first by itself: however, I always found it

* The specific gravity of the composition itself, is 8.78, with the addition of one ounce of arsenic to one pound of metal, 8.89.

full of pores, much more porous than I had ever seen it before. For some time I could not discover the true cause, having no idea that the pores were owing to the tin remaining so long in the fire in a fluid state, and therefore in a state of perpetual calcination. I attributed the porosity of the metals which I made of this composition to a multude of causes, till, thoroughly tired of experiments and conjectures to ascertain the true reason, I was determined to melt the copper first, and the tin afterwards, as I had always done, before I dropped upon this improved method, as I imagined. The result was, the metal was infinitely more compact and much less porous. By melting the copper first, and then adding the tin to it, I soon discovered that the longer the tin remained in the fire, the more porous the metal turned out; and, *vice versa*, the sooner I poured it off, after I had added the tin, the more compact and free from pores it proved. From these observations, I determined to try the effect of adding the tin in a fluid state to the melted copper, and to cool the whole immediately, to prevent, as far as I was able, calcination from taking place. Experience confirmed my conjectures, and I soon found that by pouring the whole melted mass the instant they were mixed and stirred together into cool water, the metal always proved in the second melting solid, and much more compact, beautiful, and white, than I had ever before seen it by any other process. One thing I cannot pass over, as it affords a clear proof of the use of arsenic in rendering the metal much more solid and compact, and consequently more free from pores than if no arsenic had been used in the composition. Whenever I made the composition by melting the copper and tin together, the metal was always porous as I observed before; however frequently I melted it afterwards, and though I gave it no more heat than was barely necessary to melt it, yet if I added to this very porous metal, after it was melted, a small quantity of arsenic, viz.—one ounce to one pound of the metal, it was really astonishing to see how much better the metal turned out, being considerably harder than before, and incomparably less porous. I mention this circumstance, which any one may easily try, to show the very great advantage of using a small portion of arsenic to render it more compact, and, as Sir Isaac Newton justly observes, more white than before.* The use of this small portion of brass in this composition is to render it more tough, and not so excessively brittle, as this composition without the brass would prove. A small portion of silver will make the metal much whiter, though if too much is added it is apt to be porous. Having said so much relative to the composition of the metal, which indeed is a capital article, I pass on to

The Manner of Casting the Metal.—The sand most proper for casting this, and indeed any other metal, is a fine sand with no more loam or clay mixed with it naturally, than is sufficient to make it tenacious enough to adhere together, when properly moistened. If too much clay is mixed by nature with the sand, it will always blow the metal in different directions; sometimes, indeed, to the great

* See Appendix to Gregory's Optics, p. 219; or the Philosophical Transactions, No. LXXXI.

danger of the operator. On the contrary, if the sand does not contain a sufficient quantity of clay, it will not remain in the flasks, and take a proper impression from the pattern or model. The best sand I could ever meet with, for the purpose of casting specula, is the Highgate loam, (near London,) generally used by the London founders. It should be as little wet as may be, and well beaten, but not too hard. The flasks should be at least two inches wider than the metal intended to be cast. If the sand is not of a sufficient thickness round the metal, it will instantly become dry, when the hot fluid metal is poured into it, and consequently will contract, and of course, the fluid metal will run out of the flasks. A proper thickness of sand will, however, prevent this accident. The model, or pattern, should be made of brass or hard pewter, and must be a little larger and thicker than the speculum intended to be cast from it, as the thing cast, is always a little less than the pattern, owing to its contracting a small degree in cooling. A wooden pattern will not quit the sand near so well as one made of metal; besides, wood will always warp by the moisture of the sand, and consequently will give a false figure or form to the intended speculum. As the composition I have given for the speculum is the hardest, and consequently the most brittle of any metal yet known, so is it the most difficult to cast. The common method of casting other specula will not avail in the least degree here; and it was a very considerable time before I found out a certain and infallible way to cast them free from faults or flaws in the face. In general, they cracked in the cooling, from the moisture of the sand. The only method possible to cast them well, (for indeed I have tried many methods,) is to cast them with the face downwards. The ingate or git should be at the back of the metal, and at the very edge of it; its breadth, where it joins the metal, should be at least half the diameter of the metal, and its thickness must be half the thickness of the metal at the edge; the upper part of the git should contain as much metal at least, or even more, than the speculum itself. I could give my reader sufficient reasons for every part of the process above directed, but I might be thought too tedious; suffice it then that I inform him that he will find these directions will answer in practice, and I believe I can say, that no one whatever can cast specula of this brilliant and brittle composition, by any other means, than what I have now pointed out. When the pattern, with its ingate or git, is taken out of the sand, ten or a dozen small holes should be made through the sand, at the back of the mould, with a small wire, or common knitting-needle, to permit the air to escape as the metal is poured into the mould. I have found by experience, that several small holes are infinitely better for that purpose than one large hole.* When the metal is melted a second time, which must be done with as small

* If several small holes are made for the air to escape, the back of the metal will be cast much neater than if one hole only is used for this purpose. Besides, when one hole only is used to let the air escape, the metal is very apt to crack in that place, owing to the sinking of the metal in casting.

a degree of heat as possible, add the proportional quantity of crude arsenic in a coarse powder, and stir it with a wooden spatula; when the fumes are gone off, take the metal off the fire, take away the dross, and add half an ounce of powdered rosin, or equal quantities of rosin and nitre, in order to give the metal a good face; stir it well with a stick, and pour it immediately into the flasks. When the git is filled up with the fluid metal, strike the flasks gently, so as to shake or jog the metal in them, in a small degree; this will prevent any flaws in the face from any air bubbles being lodged there. When the metal has remained in the flasks a few minutes, so as to become entirely solid, open the flasks while the metal is red hot, (it cannot crack in this state though it is exposed to the air, as all metals are malleable when they are red hot,) and take out the speculum with a pair of tongs, laying hold of it by the git, but take care to keep the face downwards to prevent it from sinking. Force out the sand from the hole in the middle of the mirror with a piece of wood or iron, and place the speculum in an iron pot, with a large quantity of hot ashes, or small coals, so as to bury the speculum in them a sufficient depth. If the sand is not forced out of the hole in the manner above directed, the metal, by sinking as it cools, will embrace the sand in the middle of the speculum so tight, as to cause it to crack before it becomes entirely cold. And if the metal is not taken out of the sand, and put in a pot with hot ashes or coals to anneal it, I can assert that the moisture from the sand will always break the metal. Let the speculum remain in the ashes till the whole is become quite cold. The git may be easily taken off by marking it round with a common fine half-round file, and giving it then a gentle blow. The metal is then to be rough-ground and figured.

The Rough-Grinding and Figuring the Speculum.—In rough-grinding, figuring, and polishing the metal, two tools only are necessary, besides a common grindstone. One chief reason why workmen do not give a good figure to their specula is, because by pursuing Dr. Smith's or Mr. Mudge's methods they use too many tools, which, in a great measure, destroy each other's effects. As nature always acts in the most simple manner, so if we could always imitate her in this respect, we should arrive at a much greater degree of excellence, in most of our mechanical pursuits. Besides, the tools generally made use of by workmen, are considerably too large in diameter, ever to give a correct and uniform figure. All the tools I make use of, are a rough-grinder, composed of lead and tin mixed together, or else of pewter; this rough-grinder serves also for a polisher; this tool, with a bed of stones, or hones, are all that are necessary. A bruiser (as directed by Dr. Smith and Mr. Mudge,) is totally unnecessary, causes considerably more work, and after all is really detrimental. The best method I have ever found to rough-grind the speculum, is to grind the surface of it quite bright, upon a common grindstone, made nearly to the figure or focus of the speculum by a gauge.* Take it then to a convex tool made of lead and tin, or else

* The grindstone may be easily brought to the form of the gauge, by holding

of pewter, and grind the metal upon it with fine emery. This emery, however fine it may be, will break up the metal very much: but we can easily cure that process, as I shall show hereafter. This tool, or rough-grinder, should be made of an elliptical form, and not circular (for a reason which I shall point out hereafter,) and of such dimensions, that the shortest diameter of the ellipse, shall be equal in breadth to the diameter of the mirror; and the longest diameter of the elliptical tool should be to the shortest diameter, in the proportion of ten to nine, accurately, for a reason likewise to be mentioned hereafter.

(To be continued.)

New and expeditious method of Squaring Numbers.

Lincoln, July 2, 1827.

Sir,—Whatever has a tendency to diminish the labour of dry and tedious calculations, can hardly fail to be acceptable to some of the readers of the Mechanics' Magazine: with this persuasion, I make no apology for submitting to them a method, by which a considerable part of the usual labour of squaring numbers may be avoided; a method, which, though it embraces no new principle, seems, as far as I know, to have been hitherto unnoticed by every writer on the subject of arithmetic.

The method here pointed out is founded on the well known principle, that the product of the sum and difference of two numbers, is equal to the difference of their squares; to which difference, if we add the square of the lesser number, we obtain the square of the greater. The principal advantage of this method is, that it enables us to perform the operation, with numbers divisible by 10, 100, &c., or which contain cyphers. If we make the number, the square of which is required, the greater of two numbers, whose sum or difference is a number divisible by 10, &c., and multiply together the said sum and difference, and to their product add the square of the lesser number, the result is the square required. For example: let 83 be a number whose square is required; then $83 + 3 = 86$, and $83 - 3 = 80$, the sum and difference; the product of which is 6880; to which add 9, the square of the lesser number 3, and we have 6889, the square of 83. If the number to be squared ends with 5, the process is still shorter, for taking 5 for the lesser number, the sum and difference are both divisible by 10: thus, $85 + 5 = 90$, and $85 - 5 = 80$; whence $90 \times 80 + 25 = 7225 = 85^2$.

The intelligent reader will perceive, that in every case we save the trouble of multiplying by at least one figure; and in many cases of much more. For example, take 997; then $997 + 3 = 1000$, $997 - 3 = 994$; by a mere mental process we obtain 994009, the square required.

the sharp end of an iron bar against it while it is turned round, till so much is worn away from its surface as shall cause it to take the true curvature of the gauge.

It is presumed, sufficient has been said to explain the above method, and to show its utility. It is equally applicable to whole or mixed numbers, fractional or decimal, and may frequently be applied with singular advantage in all. Take, for instance, the famous "Arithmetical Question," which called forth the mental energies of so many of your correspondents in your first volume. We have 99*l.* 19*s.* $11\frac{3}{4}d.$, or $99\frac{95}{960}$, and $\frac{1}{960}$; their sum 100, their difference $99\frac{95}{960}$; their product is instantly obtained $= 9900\frac{95}{960} = 9999\frac{76}{96}$, or 9999*l.* 15*s.* 10*d.*, to which add $(\frac{1}{960})$ or $\frac{1}{960}$ qrs., and the answer is obtained. Perhaps it may be still more readily done without reducing to fractions; thus 99*l.* 19*s.* $11\frac{3}{4}d. \times 100 = 9999l.$ 15*s.* 10*d.*, to which add $\frac{1}{960}$ qrs. as before. On this question allow me to say, that entertaining the same views as your former correspondents, I have no wish to revive a subject, which, together with the contentions it excited, has long since descended to "the tomb of all the Capulets;" yet, as it was allowed on all hands that the answer required was the square of the number $99\frac{95}{960}$, I trust that the calling in its aid to illustrate my subject, will not be thought derogatory to its posthumous fame.

I now proceed to inquire how far a similar method can be applied with advantage, to the finding the products of numbers in general. Let a and b be two numbers, whose product $a\,b$ is required, a being the greater; let $a + r$ and $b - r$ be two other numbers, one or both of which is divisible by 10; it is evident that $(a + r)(b - r)$ is less than ab: let n be the difference; then $(a + r)(b - r) + n = ab$, an equation in which $n = (a - b + r)\,r$, $= (d + r)\,r$ when $d = a - b$. And this value of n, added to $(a + r)(b - r)$ we have ab as required. Again, if it be convenient to take $a - r$ and $b + r$ for the two auxiliary numbers, then because $(a - r)(b + r)$ is greater than ab, let n be the difference, and we have $(a - r)(b + r) - n = ab$, whence $n = (a - b - r)\,r$, $= (d - r)\,r$; which subtracted from $(a - r)(b + r)$ gives ab as before: from hence we obtain the following convenient general rule. Arrange the four numbers like the terms of a proportion in the following order:—$a + r$, a, b, $b - r$. "Find the product of the difference between the first and second, and first and third terms, which is the value of n; then, if the first term be greater than the second, *add n to*, if less, *subtract it from* the product of the extremes; the result is the product of the mean terms."

As my object is to write intelligibly rather than learnedly, I hope an example or two will cause it to be understood by all. Let the numbers whose product is required be 96 and 93; then, taking $r = 4$ and arranging as above directed, the terms will stand thus: 100, 96, 93, 89. The product of the extremes is 8900, to which add $(100 - 96)(100 - 93,)$ or 4×7, $= 28$, the value of n, we get $8928 = 96 \times 93$. Again, let $a = 95, b = 85$; then $a - r = 90$, $b + r = 90$; the terms will stand thus, 90, 95, 85, 90. And we have $n = (95 - 90)(90 - 85,)$ or $5 \times 5 = 25$, which, as the first term is *less* than the second, must be subtracted from 8100, the product of the extremes; the result is 8075, the product required.

From the above examples it appears, that when the numbers are

such that the value of n can be obtained mentally, or with little trouble, there is a decided advantage in using this method. I have neither time nor inclination to pursue this subject further at present, but should be glad to see it taken up by some one better qualified for the undertaking; what I have done, I submit, with great deference, to the judgment of the candid and judicious reader. J. B.

P. S. Since the above was written, I have had the pleasure of witnessing the surprising powers of Master Noakes, a child of seven years old, who is now itinerating in this county, for the purpose of displaying his abilities in arithmetical computations. I was much gratified to find, that in the squaring of numbers, he uniformly made use of the above method. Whether he has been taught it, or whether it *suggested itself* to his extraordinary mind, I did not ascertain; nor is it of consequence to know: it is sufficient that we have, at least, *his* approbation in its favour. [*London Mechanics' Mag.*

Notice of the pressure of the Atmosphere, &c. within the Cataract of Niagara, in a Letter from Captain BASIL HALL, *Royal Navy, F. R. S.*

TO PROFESSOR SILLIMAN.

NEW YORK, OCT. 29, 1827.

My Dear Sir: If you think the following notice of an experiment which I made at Niagara, early in July last, worthy of a place in your excellent Journal, it is much at your service.

You may remember, perhaps, that some time ago, it was suggested by Messrs. Babbage and Herschell, in a paper, I believe, upon barometrical measurements, that there was reason to suspect a change of elastic pressure might be found in the air near a water fall; and it occurred to me, when I was making preparation for the present journey, that a good opportunity, for bringing this subject to the test of experiment, might present itself at the Falls of Niagara. I accordingly provided myself with a mountain barometer, of great delicacy of workmanship, in some degree differently fitted up from the ordinary instruments of this description; and it may be worth while, to mention the particulars of its construction.

In the first place, as it is essential to the accuracy of barometrical measurements, that the tube be held in a vertical position, and as the instrument is often exposed, especially at the upper stations, to the action of high winds, it is of consequence, to have some method of ensuring this position throughout the observations. Mr. Thomas Adie, instrument maker, in Edinburgh, in conjunction with Mr. Jardine, the eminent civil engineer, devised a small fixed circular spirit level on the top of the instrument, the bubble of which is made to stand at the centre, when the tube is perfectly upright. In order to bring it to this position, four screws are necessary at the collar, near the centre of motion, by which, not only the requisite adjustments

are made, but the instrument can afterwards be firmly secured in its place. In other respects, it did not differ from the best mountain barometers, where both surfaces of the mercurial column are capable of being observed; and where, consequently, the observation being direct, no allowances or corrections are required.

Some days after reaching Niagara, I went behind the sheet of water, on the Canada side of the Falls, and although circumstances did not promise very favourably, I resolved to try what could be done with the barometer, in a place where no similar instrument had probably ever been set up.

I think you told me that you did not enter this singular cave on your late journey; which I regret much, because I have no hope of being able to describe it to you. In the whole course of my life, I never encountered any thing so formidable in appearance: and yet, I am half ashamed to say so, as I saw it performed by many other people, without emotion; and it is daily accomplished by ladies, who think they have done nothing remarkable.

You are perhaps aware, that it is a standing topic of controversy every summer, by the company at the great hotels, near the Falls, whether the air within the sheet of water is condensed or rarified; I had therefore a popular motive as well as a scientific one, in conducting this investigation; and the result, I hope, will prove satisfactory to the numerous persons who annually visit Niagara.

As a first step, I placed the barometer at the distance of about one hundred and fifty feet, from the extreme western end of the Fall, on a flat rock, as nearly as possible on a level with the top of the 'talus' or bank of shingle, lying at the base of the overhanging cliff, from which the cataract descends. This station was about thirty perpendicular feet above the pool, or basin, into which the water falls. The mercury here stood at 29.68 inches. I then moved the instrument to another rock, within ten or twelve feet of the edge of the fall, where it was placed, by means of a levelling instrument, exactly at the same height as in the first instance. It still stood at 29.68—and the only difference I could observe, was a slight continuous vibration, of about two or three hundreths of an inch, at intervals of a few seconds.

So far, all was plain sailing: for though I was soundly ducked by this time, there was no particular difficulty in making these observations. But within the sheet of water, there is a violent wind, caused by the air carried down by the falling water, and this makes the case very different. Every stream of falling water, as you know, produces, more or less, a blast of this nature: but I had no conception that so great an effect could have been produced by this cause. I am really at a loss how to measure it—but I have no hesitation in saying, that it exceeds the most furious squall or gust of wind I have met with in any part of the world. The direction of the blast is generally slanting upwards, from the surface of the pool, and is chiefly directed against the face of the cliff, which being of a friable shaly character, is gradually eaten away; so that the top of the precipice now overhangs the base, thirty-five or forty feet; and in a short

time, I should think, the upper strata will prove too weak for the enormous load of water, which they bear, when the whole cliff will tumble down. These vehement blasts are accompanied by floods of water, much more compact than the heaviest thunder shower; and as the light is not very great, the situation of the experimenter with a delicate barometer in his hand, is one of some difficulty. By the assistance of the guide, however, who proved a steady and useful assistant, I managed to set the instrument up, within a couple of feet of the "termination rock," as it is called, which is at the distance of one hundred and fifty-three feet from the side of the water fall, measured horizontally along the top of the bank of shingle.

This measurement, it is right to mention, was made a few days afterwards, by Mr. Ed. Deas Thompson, of London, the guide, and myself, with a graduated tape.

While the guide held the instrument, firmly down, which required nearly all his force, I contrived to adjust it, so that the spirit level on the top, indicated that the tube was in the perpendicular position. It would have been utterly useless to have attempted any observation without this contrivance. I then secured all tight, unscrewed the bag, and allowed the mercury to subside: but it was many minutes before I could obtain even a tolerable reading, for the water flowed over my brows, like a thick veil, threatening to wash the whole affair, philosophers and all, into the basin below. I managed, however, after some minutes delay, to make a shelf or spout with my hand, which served to carry the water clear of that part of the instrument, which I wished to look at, and also to leave my eyes comparatively free. I now satisfied myself, by repeated trials, that the surface of the mercurial column, did not rise higher than 29.72. It was sometimes at 29.70, and may have vibrated two or three hundredths of an inch.

This station was about ten or twelve feet lower than the external ones, and, therefore, I should have expected a slight rise in the mercury; but I do not pretend to have read off the scale, to any great nicety; though I feel quite confident, of having succeeded in ascertaining, that there was no sensible difference between the elasticity of the air at the station on the outside of the falls, and at that, one hundred and fifty-three feet within them.

I now put the instrument up, and having walked back towards the mouth of this wonderful cave, about thirty feet, tried the experiment again. The mercury stood now at 29.68, or at 29.70, as near as I could observe it. On coming again into the open air, I took the barometer to one of the first stations, but was much disappointed, though I cannot say, surprised, to observe it full of air and water, and consequently, for the time, quite destroyed. My only surprise, indeed, was, that under such circumstances, the air and water were not sooner forced in. But I have no doubt, that the two experiments on the outside, as well as the two within the sheet of water, were made by the instrument, when it was in a correct state; though I do not deny, that it would have been more satisfactory to have verified this, by repeating the observations at the first stations.

On mentioning these results to the contending parties in the controversy, both sides asked me the same question. "How then, do you account for the difficulty of breathing, which all persons experience, who go behind the sheet of water?" To which I replied, "that if any one were exposed to the spouts of half a dozen fire engines, playing full in his face, at the distance of a few yards, his respiration could not be quite free; and for my part, I conceived that this rough discipline would be equally comfortable in other respects, and not more embarrassing to the lungs, than the action of the blast and falling water, behind this amazing cataract."

I remain, most sincerely, your obedient servant,

BASIL HALL.

[*Silliman's Journal.*

Mr. Genet's remarks on the animadversions of the Editor, on his memorial, on the Upward forces of Fluids.

IN the number of Professor Silliman's Journal, for the present month, (January,) we find the subjoined communication from Mr. Genet; our readers will perceive that it is dated in August last; we are not yet informed of the result of the experiments, in the *laboratory*, and *school* of *aerostation* at fort Gansevoort; when any thing important transpires, we shall hasten to spread it out on our pages. We did not expect an *answer* to our lucubrations, but supposed, as appears to be the case, that Mr. Genet would follow his friend Pascalis into dignified retirement; *neque semper arcum tendit Apollo.*

TO PROFESSOR SILLIMAN.

New York, August 30, 1827.

"*Sir*—Through the kindness of your printer, I have received a proof sheet of Dr. Jones' (I am ashamed to repeat it, for the honour of philosophy,) *animadversions* on my memorial, on the upward forces of fluids, and if it is not too late,* I hope that these few lines will also find, in the same number of your Journal, where those appalling *animadversions* will appear, the following humble and short rejoinder; namely, that being satisfied that in experimental philosophy and practical mechanics, results and facts are the best means of settling points in dispute, I have cultivated, since last fall, in this city, the friendship of philanthropic philosophers, whose pleasure consists in encouraging whatever may eventually be useful; of liberal citizens, who are always willing to promote the arts; of good hearted mathematicians, who like better to rectify than to rebuke; and of able and public spirited mechanics, whose experience is a sure guide; and that owing to those favourable circumstances, and an elaborate investigation of whatever, in the science of mechanics, has any connexion with my plans, I have very much improved my mechanical combinations, for the navigation of the air and water, by hydrostatic and

* The number containing Dr. Jones' animadversions was already finished when this letter arrived.—[*Silliman.*]

aerostatic forces. I shall, in a few days, sir, be able to make experiments that will attest, 1st, the available power of hydrostatic pressure, and aerostatic levity, to propel boats or vessels, deducting all friction and resistance; and 2nd, the additional advantages of a pump totally different from those that I had at first contemplated, that will double, instead of diminishing, my powers. I have been also preparing a system of machinery, very much simplified, to steer the aeronauts in favourable currents, and endow them with the faculty of raising and lowering themselves by inclined planes, into more favourable strata, if they meet adverse ones: and when my friend Eugene Robertson, whom I expect every day, is arrived, we shall be able to begin progressively, according to our means, our aerostatic experiments, in a fort of this city, which, under the auspices of our general government, solicited by Mr. Clinton, governor of this State, has been designated for that purpose. The spacious and circular yard of that fort, called, after the late general Gansevoort, and the adjoining buildings, will become an excellent laboratory and school of aerostation. In the mean while, Dr. Jones may animadvert as much as he pleases; he may rest assured that I shall not take the trouble of answering his lucubrations, following in that respect, the example of Montgolfier, who, when he published his discovery of the balloons and his contemplated experiments, was assailed from all quarters, with the most scientific dissertations, attempting to prove by all the rules of mathematics, and the formulas of algebra, that he would fail. I am, I confess, more than ever sanguine in my expectations; but if I am disappointed, you will, I know, sir, be one of those who will say, as of the unfortunate Phæton, *Magnis tamen excidit Ausis.*

Respectfully yours, E. C. Genet."

A description of the mode of extracting the Fecula from the Potato.

Communicated from G. G. Barrell, Esq. Consul of the United States, at Malaga, to H. A. S. Dearborn, Esq. Boston.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Brinley Place, Roxbury, Oct. 29, 1827.

Sir—Last December, I received a communication from G. G. Barrell, Esq. Consul of the United States, at Malaga, containing a treatise on the mode of extracting the fecula from the potato, which was published in the New England Farmer. Mr. Barrell has since transmitted to me, drawings of the machine, described in the treatise, which I offered to Mr. Fessenden, to be engraved for his paper; but he observed that he could not get them done in such a manner, as to do justice to the delicate parts of the machinery, or he should willingly give them publicity. As Mr. Barrell has discovered great solicitude, to render the information he has obtained, useful to his

country, I have thought, it could not be better done, than through the medium of the Franklin Journal, and therefore enclose a copy of the first communication, which was printed in the N. E. Farmer, and an extract from Mr. Barrell's last letter, with the drawings. If you deem them worthy of notice, I shall be obliged to you for giving them publicity.

Besides the various uses named in this correspondence, to which the fecula of the potato may be applied, there is that of starch, in our numerous cotton manufactories, and in the laundry of every family. On inquiry, I find there were used last year, in the Waltham Factory, 37,734 pounds of starch, which cost 2,075 $\frac{37}{100}$ dollars; from which it results, that the annual consumption for the cotton factories alone, in the six New England States, must amount to at least 1,000,000 pounds, and cost over 50,000 dollars. From these data, it can readily be perceived how great is the demand in the whole Union, for all the purposes to which starch is now applied.

With great respect, &c.

H. A. S. Dearborn.

Brinley Place, Roxbury, December 13, 1826.

Dear Sir—The enclosed treatise on the mode of extracting the fecula, or flour, from the potato, was recently transmitted to me, by G. G. Barrell, Esq. Consul of the United States at Malaga, who states that "it was drawn up by a most intelligent and worthy man," and he desires "that it may be published for the public good."

Mr. Barrell is of opinion, that appropriating the potato, both of the northern and southern states, to this use, cannot fail of becoming of vast importance to the country; not only as a substitute for sago, arrow-root, and other delicate aliments, but, for flour in pastry, and as starch; of which, great quantities are imported into all the West India Islands, South America, Mexico, and the Italian States, at an enormous expense.

Mr. Barrell has before evinced his solicitude for the advancement of agriculture, by forwarding several kinds of grain, and valuable information, on the method of cultivating them, to one of our societies. Such instances of patriotic zeal, and generous devotion to the prosperity of his native land, merit the grateful acknowledgments of his fellow citizens. It is by such contributions to our fund of intelligence, upon all the branches of national industry, that Americans, who reside in, or visit foreign countries, can best subserve the republic; and it is pleasing to find, that many of them cheerfully avail themselves of the advantages of their situation; and it is most desirable, that all our public agents should make it a point to collect and transmit to the United States, whatever may tend to increase the number and variety of our products, of agriculture, manufactures and the arts.

Very respectfully, yours, &c.

H. A. S. Dearborn.

J. G. Fessenden, Esq. *Editor of the N. E. Farmer, Boston.*

Malaga, September 26, 1826.

Dear Sir—Permit me to communicate to you, the result of an essay I made some days ago on the sweet potato, a native of the free and happy country you so worthily represent, and where I think that the use, to which this excellent vegetable is generally applied, may be improved to great advantage.

You, no doubt, have heard of the vast consumption, which has lately taken place in France, of the fecula, or flour, proceeding from the common potato; where, in consequence of the repeated certificates, given by the Proto Medicate of Paris, it has been introduced into almost all the apothecaries' shops, and hospitals, in the south of France, and is found to produce a variety of most delicate and nutrimental aliments, for people of weak digestion and relaxed intestines; such as excellent gruel, porridge, and all kinds of pastry, far superior to that made with flour; as also starch of the very first quality; and which nothing, apparently, could exceed in whiteness.

A consideration of these facts, first induced me to turn my attention to the sweet potato, and suggested the idea, that it might be applicable, in some degree, to the same purposes; and having accordingly resorted to the process usually adopted, for extracting the fecula of the common potato, I found, to my no small surprise and satisfaction, that it produced that substance, in vastly greater quantity, and, if possible, in superior quality, particularly in whiteness; besides possessing in a much greater degree, the saccharine qualities inherent in the plant.

These circumstances will, no doubt, suggest an idea, to a person of your active and penetrating mind, of the immense advantages, that would, unquestionably, accrue to the southern states of America, from applying this admirable vegetable to the many purposes of which it is susceptible. I shall, therefore, proceed to describe to you the simple method which may be used, for the extraction of the fecula. It is as follows:—

A wooden cylinder [*see the drawings*] is required, of about three feet in circumference, and four in length, covered with tin, perforated like a grater, which on wearing out, may be taken off and renewed; on the top is placed a wooden box, or hopper, capable of containing five or six bushels, in such a manner as to embrace about a quarter of the circumference of the cylinder, and so adjusted to it, as only to let the fibres of the potatoes pass in the operation of grinding. This cylinder, with its hopper, is placed over a tub, of an oval form, and filled with water, in such a manner, as that it should dip in that element at each rotation, which is performed by means of a crank, like that of a grindstone; by this means, the paste and fibrous substance are washed away, and the instruments kept clear; there falling, together with the fecula, into the water, a separation immediately takes place; the latter by its specific gravity precipitating itself to the bottom of the tub, where, in a few minutes after pouring off the water with the fibres, it appears white, and in a solid compact mass. In order to complete the operation, nothing further is requisite, than to stir it up with clean water, and percolate it once or

twice, through a sieve, when it becomes of a whiteness far surpassing common flour, or starch, and of a more glutinous and tenacious quality than the latter.

According to the experiment I have made, with respect to the quantity of fecula produced, by the sweet potato, I find that four and a half bushels of that vegetable, when at maturity, will produce one bushel of fecula, which is at least 50 per cent. more than the produce of the common potato, in this country; it has besides the grand advantage of being fit for use all the year round, if properly preserved, it being but in a very small degree, subject to germination; whereas, the common potato on beginning to sprout, produces very little fecula; and is in a state for grinding, only about five months in the year. The fibres of both kinds of potatoes make excellent food for cattle, pigs, sheep, fowls, &c.

The fecula, when extracted, is dried in the sun, on thin plates, either of glazed earthenware, or tin; and may be formed into any shape, or made fine like flour.

In order to facilitate the operation, on a grand scale, a fly wheel may be applied to two or more cylinders, at the same time, by placing them within about three or four inches of one another, by which means, immense quantities of potatoes may be ground in a day, without a greater impulse than that of a single man, or even a turnspit dog. In a country, however, where the powers of machinery, and steam, are so well known, as in America, it would be useless and impertinent to make further observations on that subject: I shall, therefore, conclude with a few observations on the washing of the potatoes, previous to grinding them for extracting the fecula. This operation is of the greatest consequence, and in fact is the only laborious part of the process, as it is usually conducted; as great care must be taken to have the potatoes well washed, in order to prevent the earth accompanying them, from mixing with the fecula; and it appears to me, that a more expeditious method might be invented, than the common one; as, by suspending, horizontally, a long cask, which may be turned, like the above mentioned cylinders, by a fly wheel; this might be filled about two-thirds full of potatoes, and afterwards filled nearly full of water. It should be furnished on the inside with strong bristles, in the form of a hard brush, and here and there long wooden pins, rounded at the end, to prevent the bruising them too much in the act of rotation, which would be very violent. It should likewise have a cock, or plug, at the bottom, for drawing off the water when soiled, which may be renewed, till they are thoroughly cleansed. The whole of this operation may be performed in a very few minutes.

Your infinitely obliged,
And very faithful servant and friend.

To G. G. Barrell, Esq.

[TO BE CONTINUED.]

FOR THE FRANKLIN JOURNAL.

Observations on the situation of the Fulcrum in Levers; and on Stress and Friction on Journals, in the communication of Motion. By R. TYLER, *Mechanician.*

TO THE EDITOR.

Sir—IT has been frequently observed, that a lever of the second kind, has the advantage of being shorter than one of the first kind, of the same power, and length of arm. It does not appear, however, that the observation has been generally followed up, so as to derive those advantages from it, which, I think, a little attention will make evident. It is curious also to observe the great practical superiority of this kind of lever in many other respects, particularly where only a small gain of force is required, say, for example, a force of 2 to 1, that is, that, in either case, the longer, shall be to the shorter arm, in that proportion.

That there is a difference in their length, will be evident from the consideration, that in one case, the long and short arms are on opposite sides of the fulcrum, while in the other, the short arm forms a part of the longer one, being on the same side of the fulcrum; and a moment's reflection will make it clear, that in the present example, the length of the lever of the second kind, is to that of the first, as 2 to 3. It is evident, that the same proportion would hold good for their relative weight, supposing them to be bars of even thickness, and equal to one another; but it appears that the longer bar should have just twice the stiffness of the shorter one, and therefore must be considerably increased in thickness, for, the momenta of the forces acting at the extremities of the longer lever, are twice as great as the momenta of the forces at the extremities of the shorter lever; it follows, therefore, that the tendency of these forces to strain, or bend, the levers, at the third or middle force, is twice as great in the longer, as in the shorter lever; hence it appears, that their weights will probably be nearly, as 2 to 5, in well proportioned levers.

A reference to the figures will show, that in fig. 1, the fulcrum F is pressed with a force three times as great, as that in fig. 2; hence the *strength* of those axles, or centre pins, should be three times as great in fig. 1, as in fig. 2; but it is requisite that the extent of the rubbing surface of each fulcrum, should bear a due proportion to its load; wherefore its *diameter* (if a cylindrical pin, or bolt) should be about double the size in the former, as in the latter case. Now the friction of a sliding body, being as the pressure, nearly, and the power or influence of *any force*, concerned in the lever, as its distance from the centre of motion, we have only to multiply the pressure on each fulcrum, by its diameter, to find the relation of friction in the two cases. In fig. 2, the pressure, and the diameter, and their product is 1, and in fig. 1, the pressure being 3, and the diameter 2, the product is 6, showing the *friction* to be as 1 to 6.

The comparison will be better shown by the following table:

Length	as 2 to 3	Do. on fulcrum	as 2 to 6
Weight	as 2 to 5	Diam. of do.	as 2 to 4
Stress	as 2 to 4	Friction of do.	as 2 to 12

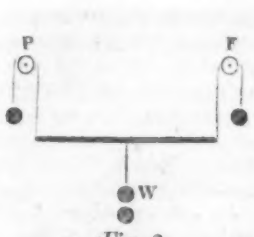


Fig. 2.

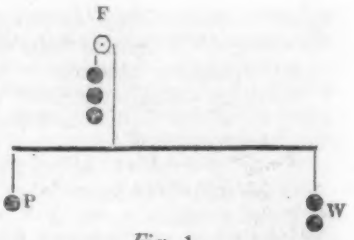


Fig. 1.

To which may be added a corresponding difference in the beds, or frames, in which the levers are used.

Connected with this subject, I may remark that too little attention is paid to the avoiding of stress and friction, in the arrangement of machines generally. We frequently see the power communicated to a machine, through a train of wheels, pullies, drums, &c., all acting as levers of the first, instead of the second kind, even where the speed is not changed; in which case the arms of each lever being equal, the disparity between the first and second kind, as regards friction on the axles, is infinitely greater than in the case above represented, that is to say, that in levers of equal arms, when the second kind of lever is employed, there is *no* force thrown on the fulcrum in consequence of the action of the *power* and *weight*, these forces being exactly opposite to each other; whereas, in the lever of the first kind, the fulcrum being placed between the power and weight, sustains the sum of both, and this, of every axle in the train, from the first mover, to that immediately concerned in performing the work.

I do not mean to say that such arrangements are not sometimes judicious, and even unavoidable, but, that they more frequently arise from the ignorance, or inattention, of the engineer.

Every skilful mechanician knows that the friction of a machine, depends in some measure on the number and nature of the rubbing surfaces; but he does not always bear in mind, especially when each axle has its own appropriate work assigned it, that every one in the train, sustains a load, equal to twice the *degree* of force communicated through it, to the next succeeding wheel, or drum, independently of that which arises from its own particular resistance; and that this takes place in the lever of the first kind, only.

I am aware, that the example above mentioned of the second kind of lever, of equal *arms*, is a contradiction of terms; that it is *as much* a lever of the third as of the second kind, or may, in fact, be considered as no lever at all, since there is no third force or fulcrum required; still it is no more than an extreme case, and therefore very proper for the purpose of illustration.

In order then, to diminish as far as possible the stress and friction in the communication of motion, or power, by means of the lever, whether in the wheel, pulley, or drum, &c. it may be laid down as a rule, that *the power and resistance* (*or weight*) *should always act on*

the same side of, and at equal distances from, the fulcrum. A rule, which though it cannot often be strictly observed, will repay the trouble of bearing in mind.

It may be worthy of remark in this place, that the weight of a heavy wheel, or shaft, may sometimes be employed as a substitute, for pressure on its journals, in order to confine it in its proper situation.

Fig. 3.

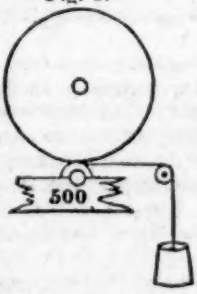


Fig. 4.

An example is presented in fig. 3, where a vertical sparr wheel weighing 500 pounds, receiving its motion from a small pinion at its lowermost point, is just sufficiently heavy to keep it in contact with its driving pinion, and prevent it from being raised *out of gear*, while it is employed in raising a heavy weight, or otherwise exerting an enormous force, in direct opposition to that received from the pinion. Abstract the weight of the pinion, and it is evident that the only pressure on the journals of both wheel and pinion, is that caused by the weight of the wheel, viz. 500 pounds on the bearing underneath. Now if we suppose the weight of the wheel to be taken away, we shall in its stead require a pressure downwards, of 500 pounds on its journal; while that under the side of the pinion, will not be at all effected by the change; but we shall then have 1000 pounds pressure, 500 below and 500 above: if we now add to the pinion the weight which we have taken from the wheel, we shall then have 1500 pounds pressure, or 1000 below, and 500 above, and we shall have only placed the pinion, or light wheel, above, as in fig. 4. If we suppose (as is natural) the pinion to have weight, we still have this rule, by which to determine the case, in placing the lighter wheel above, and below; the difference of pressure on the journals will be equal to double the difference in the weight of the wheels; the heaviest wheel being just sufficient to overcome their tendency to separate.

Patent Phenix Mill Canvass.

We have received a small pamphlet containing very satisfactory certificates of the superiority of the sail duck, manufactured at Paterson, New Jersey, by the Phenix manufacturing company, and should have noticed it in our last number, but for the disarrangement consequent upon the fire in Mr. Harding's office. We shall always be obliged by the receipt of information either from individuals or companies engaged in manufacturing establishments, which will enable us to take such notice of them as their extent and utility may justify. But few of our own citizens are aware of how much is really

done in manufactures, and are, consequently unable to make a correct estimate of the importance of this branch of industry, and of the justice and force of its claims to public and private patronage. A correct and full view of what we have actually accomplished in this way, would have a salutary influence upon the minds of our own citizens, and would exhibit us to foreign countries, as having attained a state of vigorous maturity, in the lapse of a few years, of which they have no conception, but which, when known, must tend to our advantage.

The following is extracted from the pamphlet above named:—"As ship owners, those interested in shipping, and the friends of domestic manufactures, must see their own advantage in being independent of foreign nations in the important article of *canvass*—the duck manufactured at this establishment is brought to your notice and patronage, in the confidence that it will be found more economical than any foreign canvass, as will be satisfactorily confirmed, by referring to those who have been in the habit of consuming the article.

"The material of which it is composed, is the best water retted flax that can be procured—the warp and filling are doubled and twisted into twine, which makes the yarn nearly twice the diameter and strength of the yarn of other canvass—the quantity of material in the same surface is consequently greater, which necessarily increases the durability, and yet its softness and pliability far exceed that of any other description, which, in handling a sail, is an important requisite.

"The cloth is woven without starch, which renders it less liable to mildew, and it is a fact well established, that this is the bane of all foreign canvass, causing more destruction than the actual wear.

"The cloth is bleached by steeping in an alkaline ley, without any preparation that can injure the fibre of the yarns, or texture of the cloth; and great confidence is experienced in recommending this canvass, as no expense or labour is spared to improve the quality, in every process of the manufacture.

"Orders for *U. S. Navy Duck*, *Russian Imitation Duck*, *Cotton Bagging*, *Hammocks*, *Hammock Cloth*, *Tarpaulins*, and all kinds of *Flax Yarn and Cloths*, will be thankfully received, addressed to 'The Phenix Mill, Paterson, N. J.'"

The certificates are of different dates, from 1820 up to the present time: the first is from the navy commissioners, and is signed by Commodore Rogers; it states the result of a trial by Commodore Porter to be, that this canvass proved "to be greatly superior to either English or Russia. It possessed twice the durability." "The Commissioners of the navy are decidedly of opinion that the American canvass, tested by them, is greatly superior to any ever imported into our country.

Captain Hamilton states that "after a voyage to Liverpool and back to this place, (Philadelphia,) during which they were in constant use, and exposed to a good deal of tempestuous weather, they retain the appearance of having been bent but a few days."

Capt. Barnard of New York says, "I have the highest opinion of its goodness. In the first place, it does not mildew like foreign canvass—it is soft and pliable, and wears much better than any canvass I ever used—nor does it shrink and stretch like foreign canvass, having had it in use two voyages to Europe, and experienced very bad weather."

Captain E. Hawkins of the Havre packet line, New York, says, "I have worn the Phenix Mill duck, for some time, and can safely say that I have the highest opinion of its pliability, durability, and resistance of mildew. Those who try it will scarcely procure any other, as it will undoubtedly be found the best and most economical canvass that we can procure any where, and I have great pleasure in recommending it to the notice of all consumers of the article."

There are numerous other certificates to the same effect.

The first cost of the American canvass is stated to be less than that of Holland, or Russia, notwithstanding its greater durability. The pamphlet closes with the following remarks.—"The great superiority of this duck consists in the fact that it does not mildew, which does not arise from the use of any process to prevent it, but from the circumstance of not using that which causes it.—Many attempts have been made in England to deprive the starching of its destructive power, by tanning and the use of acids, but all in vain. As long as manufacturers pay more attention to the appearance than they do to the substance, so long will it be used in all cloth, and its injurious effects will continue to be experienced by the consumer.

"In nearly seven years' experience in the wear of this article, during which time we have had repeated contracts with the Navy of the United States, we never have had a complaint of duck manufactured from water retted flax; we feel, therefore, that we are justified in recommending it to the ship owner; more especially as the foregoing letters carry with them unequivocal proofs, of its superiority over any other description of canvass—and these evidences of its excellence are accumulating upon us every day.

"It is our interest to sustain the good reputation of the duck, as we have invested a capital of 140,000 dollars in buildings and machinery: it can never be supposed, therefore, that for a temporary gain of one thousand dollars, we should make an inferior article, and, with loss of reputation, sacrifice this capital. On the contrary, our interest and our disposition both demand of us, that we should even improve in quality; and we are consequently desirous of possessing every information which the ingenuity and experience of those who use it can suggest.—We trust and hope that those intentions will meet with a corresponding good feeling on the part of the consumers, and we shall insure that encouragement which we have some right to expect from our enterprise."

Townsend's 'Mechanics' Assistant.'

ALTHOUGH the invention under the above designation, has been long in use, we think that it is not as extensively known, or as highly appreciated as it merits to be. Workmen who have followed a parti-

cular routine in their operations, are rarely willing to deviate from the beaten track, excepting the new procedure can at once be made visible, and palpable, in all its parts. This state of things, however, has been visibly changing, for some years past, and a brighter era is dawning upon us, as the artisan is becoming convinced that the light of science, which has conducted the philosopher in the attainment of the true theory of many of the operations of nature, is practically applicable to his pursuits, and will enable him to perform his labours with greater facility, and to attain a higher degree of perfection than could be hoped for without its aid.

The instrument denominated the Mechanics' Assistant, consists of a brass scale, a little upwards of six inches long, and four inches wide, and by the aid of which millwrights, pattern makers, blacksmiths, carpenters, and other mechanics, may be saved the trouble of numerous tedious calculations, or, which is frequently more tedious, the arrival at the needed result, by numerous trials. We cannot detail all the purposes to which the scale is applicable, but the following will suffice to show its utility. By it may be found,

The pitch circle of any number of cogs, and any pitch;
The laying off of bevel gears, in every change of direction;
The velocity of water per second, under different heads;
The velocity of wheels when loaded;
Laying off hoppers, potters' flasks, rafters for roofs, &c.;
Ascertaining the width of streams;
Sloping the ends of braces;
Making bands, hoops, &c.;
Measuring the area of a circle; and
Finding the square which shall correspond with it;
Finding the cubic contend of cylinders, &c. &c.

The scale is accompanied by a pamphlet, which gives a clear explanation of its application to the above, and many other purposes. There are also a number of printed certificates of its value; and we have in our possession many others, written by practical mechanics, who declare that it has been a sure guide to them, and has many times repaid its cost.

Mr. David Townsend, who resides at Beaver Falls in this state, has sent some of his instruments and pamphlets to Philadelphia, for sale, and they are now in the hands of Mr. Dobson, where those interested may call and see them. The price of them is ten dollars.

Tyler's Improved Turning Lathe.

[With a plate.]

WE gave, in Vol. 3, p. 186, a description of Mr. Tyler's turning lathe, which description was accompanied by a plate, showing its structure, in detail, and to this we refer for information on this point. The plate which we now give, is more correctly drawn, and exhibits it on its cast iron stand, as recently constructed. The attention of the mechanic is particularly called to the fact of the superiority of cast iron, as a collar, a fact which has been fairly tested, and which not only diminishes the labour of the maker, but gives a solid, in-

stead of an inserted collar. We subjoin a letter from Mr. Tyler, to which we do not think it necessary to add any thing further.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Since your publication of a description of my lathe in March last, I have entered more largely into the business of lathe making, and in consequence have found it necessary, to make such improvements and alterations as would best adapt it to general use.

In order to bring the expense within the reach of every one desirous of having a good lathe, I have omitted every appendage not absolutely necessary to its usefulness; in place of the bureau part, supporting the table, I have substituted cast iron legs, through which are made holes for the pivots of the treadle, and the crank axle. It has, I think, been well proved, that the steel collar for the mandril to run in, may be dispensed with, the cast-iron itself being better for that purpose, as it is found to run a much longer time without oil.

I herewith send you a drawing of the lathe with its stand, above referred to, and which is also a better representation than that formerly published; should you think proper, you will greatly oblige me by inserting this in your useful work. R. TYLER.

List of Patents granted in the United States, from February 15th, to May 31, 1827.

FOR INVENTIONS AND IMPROVEMENTS.

In the mode of packing cotton; William C. Thomas, Richmond County, N. C. Feb. 15.

In the kiln for burning lime; Abel James, Mill Creek Hundred, Del. Feb. 15.

In manufacturing copperas; Isaac Tyson, Baltimore, Feb. 15.

In making wheels for carriages, being a machine called the wheelwright's assistant; John Sitton, Pendleton, S. C. Feb. 15.

In the apparatus for constructing teeth for harrows; Wm. M'Canaughey, New Gardiner Township, Penn. Feb. 16.

In the washing machine; Chester Stone, Middlebury, Conn. Feb. 17.

In the horse rake, for hay and grain; Moses & Samuel Pennock, East Marlborough, Penn. Feb. 17.

In preventing moths and worms from injuring skins; Samuel Storm, New York, Feb. 17.

In a machine for grinding clay for making bricks; Benjamin H. Hill, Richmond County, Geo. Feb. 17.

In the machine for pressing cotton; Philemon White, Chatham County, N. C. Feb. 19.

In the plough; Ryland Rodes, Charlotteville, Albemarle County, Va. Feb. 20.

In the percussion gun-lock; William A. Hart, Fredonia, N. Y. Feb. 20.

In the construction of locks for doors; John Brown, and George W. Robinson, Providence, R. I. Feb. 20.

In the manufacture of salt; Benajah Byington, Salina, N. Y. Feb. 21.

H. F. VISSER & CO'S IMPROVED TURNING LATHE.

In the construction of ships, and other vessels; Thomas W. Bakewell, Cincinnati, Ohio, Feb. 21.

In making pedestal feet for andirons; Edmund Smylie, New York, Feb. 22.

In the bogging machine; Squire Collins, Hillsdale, N. Y. Feb. 22.

In inlaying gold in Tortoise shell; Uriah Bailey, Newbury, Mass. Feb. 22.

In manufacturing suspenders; Abraham L. Van Horn, Philadelphia, Feb. 22.

In the pump for steam boilers; A. Judson, Sweden, N. Y. Feb. 23.

In making sofas, or portable bedsteads; Chester Johnson, Albany, N. Y. Feb. 24.

In the bee hive; Cuthbert Wiggins, Fayette County, Penn. Feb. 27.

In the mode of pressing paper; Ira White & Leonard Gale, Newbury, Vermont, Feb 28.

In the grist mill; Benjamin Overman, Greensborough, N. C. Feb. 28.

In the cutting of garments; J. G. Wilson, New York, Feb. 28.

In propelling vessels by water pressure; Elisha Fuller, North Providence, R. I. March 2.

In blowing and striking for blacksmiths; L. Hoyt and Ebenezer Pierre, Pulteney, N. Y. March 3.

In the making of seals for watches; S. Davis, H. & P. Rabbit & B. P. Grinnel, Providence, R. I. March 3.

In machinery for laying ropes; David Myerle, Philadelphia, March 3.

In making shovels; Oliver Ames, Easton, Bristol County, Mass. March 5.

In the mill for grinding apples; H. E. Paine, and S. H. Russel, Le Roy, Geauga County, Ohio, March 5.

In the making of gearing for mills; Charles Neer, Waterford, N. Y. March 6.

In the water wheel for saw mills; Thomas Shute, Tennessee, March 6.

In the making of artificial stone; Louis Mattley, Brooklyn, N. Y. March 7.

In a machine for cutting hard substances; John H. Hall, Harper's Ferry, Vir. March 7.

In the mode of engrafting teeth; Elijah A. Bigelow, Brandon, Vermont, March 8.

In wheel dampers for chimneys; James Riley and John Flanagan, Waynesburg, Penn. March 10.

In casting the feet of brass andirons; John Griffiths, New York, March 15.

In making hatter's cards; Joseph C. Seely, New York, March 15.

In the horizontal wind mill; John Reynolds, America, N. Y. March 15.

In the machine for cutting straw, &c.; Calvin Chamberlin, America, N. Y. March 15.

In an instrument called the wheelwright's assistant; Cyrus W Beach, Schoharie, N. Y. March 16.

In the longitudinal corn sheller; George E. Waring, Poundridge, N. Y. March 16.

In the mode of distilling Alcohol by steam; Anson & Norman Wolcott, Bloomfield, N. Y. March 19.

In a spring temple for weavers; A. Jenks, and J. Clewell, Holmesburg, near Philadelphia, March 19.

In the crusher and grist-mill; John G. Morse, Randolph County, N. C. March 20.

In the machine for making bricks; David Atchester, Vermont, March 21.

In pumping water out of ships by means of wind; Thomas Brownell, New York, March 23.

In the churn; Samuel L. Bagley, Hillsdale, N. Y. March 24.

In a twin plough; Noble G. Cryer, Wentworth, N. C. March 24.

In the domestic cooking stove; David Westfield, New York, March 24.

In the same; Joseph R. Page, Philadelphia, March 24.

In grinding and polishing hard and soft substances; Benjamin Green, Hartford, Vermont, March 27.

In the mode of preparing cotton roving for spinning; Gilbert Brewster, Poughkeepsie, N. Y. March 28.

In the pressing and lifting machine; Samuel Andrews, Bridgetown, Maine, March 28.

In the horse hay rake; Jeremiah Bailey, Philadelphia, March 30.

In a mode of obtaining power from certain fluids; Mark J. Brunnel, London, England, March 30.

In manufacturing shingles; Paul Hawes, Lockport, N. Y. March 30.

In a machine for trimming the edges of paper; John M'Clintie, Chambersburg, Penn. March 31.

In making watch keys; Joseph S. Davis, Providence, R. I. April 3.

In the manufacture of tobacco; J. Allen, Jr. and Charles Geoghegan, Richmond, Va. April 3.

In an instrument for working in wood; Jeremiah Bailey, Philadelphia, April 7.

In a machine for cutting tubs, buckets, &c. Jeremiah Bailey, Philadelphia, April 7.

In the homony machine; Roberts Campbell, Martinsburg, Va. April 9.

In the cider mill; Constant H. Wicks, Paris, N. Y. April 9.

In the machine for setting up hat bodies; Joseph Grant, Providence, R. I. April 10.

In the water wheel for steam boats; Robert L. Stevens, Hoboken, N. J. April 10.

In making tenons on spokes for wheels; David Sperry, Colchester, Conn. April 18.

In the spinning machine; Nathaniel Remington, Geneva, N. Y. April 21.

In all kinds of propelling machinery; William Staunton, Centre Township, Indiana, April 23.

In the turning lathe; William Patrick, Leverett, Mass. April 24.

In the steam engine; George Fleming, Goochland C. H. Va. April 24.

In preserving eggs, butter and lard; Thomas Edmundson, Pipe Creek, Md. April 26.

In the manufacturing of wool; John Goulding, Dedham, Mass. April 27.

In making clay tubes; John R. Rowell & Henry Wire, Fredericktown, Penn. May 10.

In the scraper, or team shovel; G. Davis, and J. Price, Lockport, N. Y. May 12.

In the steam engine; E. A. Lester, Boston, Mass. May 14.

In stocks; Joseph Towson, Baltimore, May 14.

In the mill for grinding paint; Allen Holcomb, Butternutts, N. Y. May 14.

In the mode of extracting oil by steam; David Dodge, Hamilton, Mass. May 14.

In marine rail ways, Joseph Webb, New York, May 14.

In a safety gate for canals; Jacob Van Dorn, Glen, Montgomery County, N. Y. May 14.

In the valve cock, for hydrants; Benjamin Stancliff, Philadelphia, May 15.

In the cotton press; Richard Jarnigan, Waynesborough, N. C. May 15.

In the horizontal piano forte; Thomas Loud, Philadelphia, May 15

In the employment of heated air, in aid of steam power; Minus Ward, Baltimore, May 15.

In funnel stoves; Hiram Wales, Randolph, Mass. May 18.

In the cast iron plough; Robert Sweeny, Warren County, Ohio, May 18.

In the machine for cleansing wheat, rye, &c. John Tyler, Claremont, N. H. May 18.

In carts for removing earth; Jeremiah Prince, Lockport, N. Y. May 18.

In the churn; Levi Rosencrans, Urbana, N. Y. May 19.

In the machine for crushing corn with the cob; S. K. Gauntt, Greenville, Tenn. May 25.

In a water-proof stiffening for hats; Stephen Hempstead, jr. Charles County, Md. May 25.

In the thrashing machine; M. Pennock, Kennet Square, Chester County, Penn. May 26.

In the mode of letting water on the water wheel; Robert & Thos. T. M'Culloch, Albemarle County, Va. May 26.

In the evolution and management of heat; Eliphalet Natt, Schenectady, N. Y. May 30.

In mills for grinding grain; Abraham Delap, and Avery Coe, Guilford, N. C. May 31.

In the machine for hulling and cleaning rice; J. Campbell, Winsboro, S. C. May 31.

ENGLISH PATENTS.

List of patents for New Inventions, which passed the Great Seal, in England, from May 26, to July 18, 1827.

To William John Hobson Hood, lieutenant in our royal navy, for his invention of certain improvements on pumps, or machinery for raising or forcing water; chiefly applicable to ships—Sealed 26th May.

To George Burges, for his invention of certain improvements in the construction of wheeled carriages, and wheels to be attached to the said carriages, or for other purposes—26th May.

To Thomas Clarke, carpet and worsted manufacturer, for his invention of certain improvements in manufacturing carpets—26th May.

To Malcolm Muir, for his invention of certain machinery for preparing board for flooring, and other similar purposes—1st June.

To John Were Clark, for his invention of an improved mode of attaching, fixing, or securing, the dead eyes to the channels and sides of ships or vessels—8th June.

To Joseph Cliseld Daniell, clothier, for his invention of certain improvements in preparing wire cards, and dressing woollen and other cloths—8th June.

To Charles Phillips, captain in our royal navy, for his invention of certain improvements on capstans—8th June.

To Hugh Evans, lieutenant in our royal marine corps, and William Robert Hale King, tin-plate worker, for their invention of a new table apparatus to promote the ease, comfort, and economy of persons at sea, or on nautical excursions—12th June.

To Thomas Don, millwright, and Andrew Smith, builder, for their invention and discovery of methods of making and constructing shutters and blinds of iron or steel, or any other metals or compositions thereof, and improved methods of constructing and fixing shutters and blinds of iron or steel, or any other metals or materials, and methods of uniting in shutters the double properties of shutters and blinds—15th June.

To Solomon Robinson, flax-dresser, for his invention of improvements in machinery for hackling or dressing and clearing hemp, flax, and tow—16th June.

To Lambert Dexter, Esq., in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of certain improvements in machinery for the purpose of spinning wool, cotton, and other fibrous substances—16th June.

To Henry Raper, Esq. a rear admiral in our royal navy, for his having found out, or invented a new and improved system of signals, first for communicating by day, by the means of flags and pendants between ships at sea, or other objects far distant from each other; in which system the colours of the flags and pendants which have heretofore served to distinguish the signals one from another, and which by distance or other causes, are extremely subject to be mistaken, may be dispensed with altogether; and secondly, for communicating by night between ships at sea, and other objects far distant from each other, by the means of lights. And which system of signals is more con-

spicuous, expeditious, and certain than any which has hitherto been employed for the like purpose—21st June.

To James Marshall, lieutenant in the royal navy, for his invention of improvements in mounting guns or cannons for sea or other service—26th June.

To John Felton, of Hinckley, machine maker, for his invention or having found out a machine for an expeditious and correct mode of giving a fine edge to knives, razors, scissors, and other cutting instruments—28th June.

To Thomas Fuller, of Bath, coachmaker, for his invention of certain improvements on wheel carriages—28th June.

To Walter Hancock, Engineer, for his invention of an improvement or improvements upon steam engines—4th July.

To William Wilson, hat manufacturer, for his having invented or found out the means or principle of extracting spirits and other solvents used in dissolving malleable gums of various kinds, and other articles employed for stiffening hats, hat bodies, bonnets, caps, and divers articles of merchandises, and converting such spirit (after rectification) into use—4th July.

To Rene Florentin Jenar, gentleman, for his invention of certain improvements in lamps—4th July.

To George Boulton, tailor, for his invention of an instrument, machine, or apparatus for writing, which he denominates a self-supplying pen—4th July.

To Thomas Sowerby, merchant, for his invention of certain improvements in the construction of ships' windlasses—4th July.

To Rene Florentin Jenar, gentleman, for his invention of a new method of filling up with metal or other suitable material the holes or interstices in wire gauze, or other similar substances which he denominates metallic linen—4th July.

To John Snelson Shenton, plumber and glazier, for his having invented or found out certain improvements in the mechanism of water closets—12th July.

To Edward Barnard Deeble, civil engineer, for his invention of a new construction or constructions, and combination or combinations of metallic blocks, for the purposes of forming caissons, jetties, piers, quays, embankments, light houses, foundations, walls, or such other erections to which the said metallic blocks may be applicable—12th July.

To Robert Vazie, civil engineer, for his invention of improvements in certain processes, utensils, apparatus, machinery, and operations applicable to the preparing, extracting, and preserving various articles of food, the component parts of which utensils, apparatus, and machinery, are of different dimensions, proportionate to the different uses in which they are employed, and may be separately applied in preparing, extracting, and preserving food, and in other useful purposes—12th July.

To William Church, of Birmingham, Esq. for his invention, and having found out certain improvements in apparatus for spinning fibrous substances—13th July.

To George Anthony Sharpe, Esq. for his invention of an improved table urn—18th July.

To Robert More, distiller, in consequence of communications made to him by certain foreigners residing abroad, and discoveries made by himself, for certain improvements in the process of preparing and cooling worts, or wash, from vegetable substances, for the production of spirits—18th July.

To Robert More, distiller, in consequence of communications made to him by certain foreigners residing abroad, and discoveries made by himself, for certain processes for rendering distillery refuse productive of spirits—18th July.

A list of patents granted by the French Government, from the first of January to the 31st of March, 1827.

To M. Calla, Engineer, Paris, for a new kind of corner stone, or boundary—5 years.

M. de Bourgoing, Paris, for the invention of a new reproductive art, called *Lithophanie*, applicable to every combination of opaque and transparent bodies—15 years.

Jaques Michel Labbaye, Paris, for an harmonic trumpet, with three ventilators, and plug keys—5 years.

Nicholas Louis Clairembourg, Rouen, for the invention of a liquid paste, for sharpening razors, and softening leather of all descriptions 5 years.

Risler, Brothers and Dixon, of Cernay, for the invention of a loom for weaving cotton, wool, flax, and silk, &c.—5 years.

Romain Desire Carillon, Paris, for a steam engine, with an inclined piston, stop, partial condenser, and metallic apparatus—5 years.

Hippolyte Brasseux, junior, Paris, for a seal with 100 mottoes, called the *Cachet Medailler*—5 years.

Messrs. Pierre Thomas Duret, junior, Antoine and Anthoine, of Paris, for a method of Paving ovens, by means of the free stone, vulgarly called *Pierre de Barbantine*—5 years.

Bernaud Chaussenot, Paris, for an apparatus for lighting up by means of *carburetted hydrogen gas*, obtained from a distillation of rosin, and other matters, liquid, as well as solid—10 years.

Jaques Boulet, Paris, for a preparation to be used in carding and combing wool, in order to lay the fibres straight—15 years.

Madame Susse, widow, (of the family of Aglae Reine Aube,) Paris, for a cylinder for stamping and marking drawings, borders, and figures, upon skins, and leather of all kinds—10 years.

Messrs. Beauvais, Camille, and D'Antremont, Paris, for a silk and woollen dressing machine—7 years.

Pierre Jaques Haize, Felix and Binet, Paris, for a safety valve for steam engines—5 years.

Charles Francois Derheims, Lyons, for a particular method of con-

structing steam boats, in shallow rivers, as well as in deep waters—5 years.

Francois Ambroise Mairet, of Fouteney, for a machine to make paper of any dimensions—5 years.

Jean Nautes Piquet, for a machine called a Polymetre, for giving the dimensions of different figures—5 years.

M. Ansman, Paris, for a comb with several rows of teeth and a handle—5 years.

Silvestre Vanboorick, Strasbourg, for a carriage with a moveable beam, and which cannot be overturned—10 years.

Pierre Castereau, Paris, for a table, lengthening by means of joints, instead of slides—5 years.

Claude Jean Baptiste Alexandre Berthault, Chalous sur Seine, for an impermeable cement—15 years.

Pierre Louis Guimberteaux, Paris, for a machine called a *Corbeau*, for carrying off or letting down any kind of materials—5 years.

Benjamin Rotch, Paris, for a machine for winding silk—15 years.

Sebastien Erard, Paris, for machinery adapted to pianos, and other purposes—15 years.

Jean Baptiste Tereygeol, Paris, for the construction of a mill for grinding flour, without mill-stones—15 years.

Joachim Rabier, Rennes, for a method of constructing wooden cylinders of all dimensions, adapted to the bellows of forges, and iron-foundries, and applicable to vats, and many other uses—10 years.

Alexis Bruno Bagnolt Gensoul, for a method of heating with economy of fuel, the pans used for winding off cotton balls—10 years.

George Pocock, Bristol, for a machine called the *Cerf-volant*, used for drawing carriages, and lifting weights, and which may also be used in navigation—10 years.

Louis Alexander Desire Hoyeau, Paris, for a machine for making clasps—15 years.

Simon Berard and James Wilkinson, for a bobbin and carriage, for spinning, stretching, and twisting silk, flax, hemp, wool, cotton, &c.—15 years.

M. Dietz, junior, Paris, for a piano of entirely new construction and mechanism—10 years.

Adrien Jean Baptiste Gourlier, Paris, for an iron rammer, called the *Fer Mobile Cylindrique*—5 years.

Claude Henri Poucet, Lyons, for a shuttle applicable to silks, &c. as well as cloth—5 years.

M. Nery, Paris, for an apparatus for preventing chimneys from smoking—5 years.

Honore Henri Nery, Paris, for a steam engine, with improved rotatory movement—10 years.

Michel Laurent Huet, Paris, for a transportable vapour bathing apparatus—5 years.

Pierre Tespaz, Paris, for an apparatus called the *Fumivore Vaporisateur Condensateur*, for condensing the vapour produced by the combustion of gas, oil, &c.—10 years.

M. De Montaignac, Bordeaux, for improvements in the making and trying of iron chain cables—5 years.

M. M. Portefais Brothers, Paris, for a dynamic lamp—5 years.

Risler, Brothers and Dixon, Paris, for a new invented loom called a *Mechoir*—10 years.

William Newton, London, for an apparatus called a *Califier and Refrigerator*, for heating and cooling fluids—15 years.

Miles Berry, London, for improvements in the machines for dressing cloths, &c.—15 years.

Francois Cave, Paris, for a machine with double levers, to cut out and stamp malleable metals—5 years.

Godefroy, Devillers, and Co., Lille, for a bobbin and shuttle for spinning flax, and other filaments—5 years.

Jean Antoine Finino, Paris, for a candlestick of bell-metal, with a driving bolt of one piece—5 years.

Francois Clemencean, Dourdan, for a machine for sifting wheat and grain—10 years.

Onesime Guiltotiere Poucet, for improvements in the shuttles employed for figured silk stuffs—10 years.

The Misses Josephine and Victoire Beauguillot, Caen, for an improved method of making the edge or ends of a piece of lace, &c.—5 years.

Charles Cunningham, London, for a machine for *making the heads of Pins*—10 years.

Marie Martin Philippe Mengin, and Jean, Alphonse Andre Francois Petit, Paris, for machines for making small nails, called *Pointes de Paris*—15 years.

Joseph Toul Carez, for a method of engraving in relief, called pantoglaphic—15 years.

M. Fichtenberg and Co., Paris, for various improvements in the fabrication of coloured paper, imitating granite, and marble, and for a method of glazing them—10 years.

M. Sayaresse and Co., Paris, for a method of making harmonic cords without knots, and of one length for each instrument—5 years.

Antoine Nicholas Duguet, Paris, for a machine called the *Petrin Mecanique* for kneading—15 years.

Touron Felix Lebrun, Paris, for a machine for making lint from old linen, &c.—10 years.

Parfuit Modeste Carpentier, Paris, for a mechanical bed and arm chair, with bandages—15 years.

Auguste Allien, Paris, for a liquid called *Marjolame*, for taking out grease spots—5 years.

Jean Kettenhoven, Paris, for sandals composed of metal—10 years.

Jean Marie Cordier, Beziers, for a process for extracting the oil, wine, or sugar, from fruits, by means of circular plates, and an hydraulic machine for presses—5 years.

Christophe, Francois and Martin Dillemann, and Jean Michel Remhard, Strasbourg, for inventing a horizontal movement, and vertical pressure upon bobbins, for cotton spinning—10 years.

Petit Comoune and Elbeuf Caplain, senior and junior, for a machine for making brads—5 years.

Pierre Bonillon, junior, Limoges, for steam vessels without or with condensers, of all pressures and expansion—10 years.

Dominique Marie Houlet, and Silvain Riverin, Paris, for a method of employing waste pieces of whalebone, in making buttons of all colours—5 years.

Laurent Blard, Paris, for a machine for stamping and closing at the same time the slides and rings called *bellieres*, used in chains for reticles, watches, &c.—5 years.

Anthelme Junin, Paris, for a method of making diamond cut, washed and gilt headed nails—5 years.

Claude Henri Poucet, Lyons, for a shuttle for weaving stuffs and cloths—5 years.

Charles Rule, Paris, for a method of extracting gas from oily, resinous, or bituminous substances, with great economy and expedition—15 years.

Jean Petit, and Meugin Montalaire, for machines for making brads, called *Pointes Depans*—15 years.

Jean Baptiste Chauvelot, Dijon, for a machine for sifting corn, removing the shoots from malt, and which, with a little alteration, may be used also as a bolting machine—5 years.

Jean Courad Fischer, junior, Paris, for a kind of steel, called an *Acier Meteorique*—15 years.

Jean Thomas Hutter, Lyons, for a mechanical oven, for glass works —5 years.

Charles Cote, Lyons, for a piano with keys placed in the cords, and for improvements in the trimming of the hammers in all kinds of pianos—5 years.

Dubelles Jaques, Jean Pilot, and Louis Kerever, Morlaix, for a method of making common and hydraulic lime of great strength—10 years.

M. Lepine, Paris, for a gas generating lamp called a *gaza-lampe* —10 years.

William Furnival, of Ashton, for a new apparatus for making salt, which may be removed from place to place—15 years.

Cazalat Antoine Galy, Paris, for a percussion gun and its charge —10 years.

M. Fortier, Paris, for a cast iron stove, for the circulation of warm air—5 years.

Jean Joseph Allard, for a self-supplying lamp—10 years.

Devillez Bodson and Son, Bazeilles, for a machine for making handles for frying pans—10 years.

Cazalat Antoine Galy, and Jules Joseph Dubain, Paris, for the invention of a propelling power, acting without machinery, to take the place of steam in trading vessels, and insubmersible fire ships—10 years.

Eugine Valentia Ledoux, and Louis Etienne Herhan, Paris, for a new invented mould for casting types, and a machine for making grooves applicable to casting—15 years.

NOTICES.

To Subscribers.—A work like the Franklin Journal, which is distributed in nearly every state in the Union, must depend for its continuance, upon the punctuality of individuals who cannot be personally called upon for their subscriptions. Hitherto, neither the publisher or the Editor, has been compensated for his services, and although it is very gratifying to aid in the diffusion of information through our common country, the privilege of so doing may be purchased at too dear a rate. Hereafter, we shall prune and lop, without hesitation, until we have removed all those branches which bear no fruit themselves, and injure those which do.

Some subscribers have objected to payment in advance, because they are without security that the work will be continued; this sort of objection has been made by several who were formerly subscribers to the 'American Mechanics' Magazine,' published in New York. The Editor of the Franklin Journal has suffered much loss, in consequence of the agreement made with the proprietors of the former work, from whom their subscription list was purchased, and who afterwards failed to complete the volume, for which many of its patrons had paid. There is no danger of a similar termination in the present case, for although we have not become wealthy by the aid of the Journal, we are in no danger of bankruptcy; and we are not anxious to trust those who are unwilling to trust us.

Delay of the present number.—It has not been in the power of the printer, to complete this number until long after the time at which it was due, and it is probable that the next, also, will be somewhat retarded. A fire in a very extensive printing office, produces a disarrangement which it is a work of much time to correct.

Essays on Lithography.—The last three numbers of the *Journal des Connaissances Usuelles*, have not contained a continuation of these essays; they will probably be resumed in the next. We wish to complete them before offering some further information on the same subject, of which we are possessed. Our design is to make this subject as complete as possible. We are much gratified in being able to state, that Messrs. Carey and Lea of this city, have now a press at work; the measure of success which has already attended their efforts, and their known enterprise and perseverance, are sufficient guarantees that the business will be finally established.

Correspondents.—We have several communications on hand, some of which, though not suitable for publication, suggest topics upon which we intend to make observations; though we are compelled to delay, we will not finally neglect them.